TM 8267

BOARD OF TRADE
CIVIL AVIATION DEPARTMENT
SIGNALS TRAINING
BLOCK D, BLETCHLEY PARK
BLETCHLEY, BUCKS.

TM 8267

110 MHz
Range Unit

INSTRUCTION MANUAL

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MARCONI INSTRUMENTS

Instruction Manual
No. EBM 8267
for

110 MHz Range Unit

TM 8267

M.I. Technical Publications

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MARCONI INSTRUMENTS LIMITED
ST. ALBANS HERTFORDSHIRE ENGLAND

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Chapter 1

General information

1.1 INTRODUCTION

The 110 MHz Range Unit, TM 8267, is a plug-in unit for use with a TF 2401 series counter and a function unit. With this plug-in fitted, direct counting up to 110 MHz, and time interval measurement up to a resolution of 10 nsec can be performed by the counter.

TM 8267 contains the counter system's A input amplifier, gate control circuitry and high speed decade counting unit.

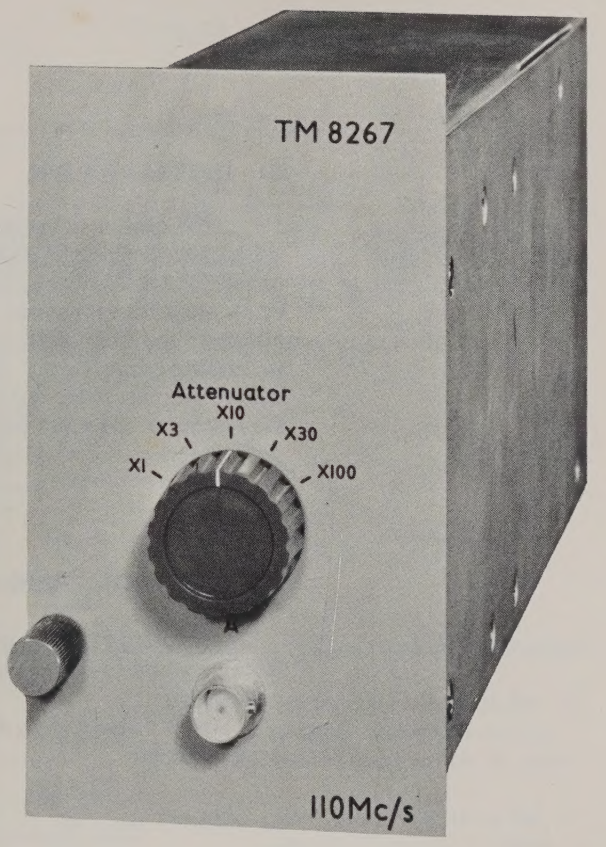


Fig. 1.1 110 MHz Range Unit, TM 8267

1.2 DATA SUMMARY

INPUT: Single channel (A).

RANGE: 10 Hz to 110 MHz.

SENSITIVITY: 0.1 V r.m.s., 10 Hz to 110 MHz.

ATTENUATOR: Factors of 1, 3, 10, 30 and 100, switch selected.

INPUT IMPEDANCE:

Attenuator setting	*Approx. input resistance*	*Shunt capacitance*
x1	10 kΩ	20 pF approx.
x3	30 kΩ	10 pF
x10	100 kΩ	10 pF
x30	300 kΩ	10 pF
x100	1000 kΩ	10 pF

MAX INPUT LEVEL: 3 V r.m.s. on x1 attenuator setting; 100 V r.m.s. on x100 attenuator setting.

GATE TIMES: As for basic counter.

ACCURACY: ±1 count ± time base accuracy.

WEIGHT: 5 lb (2.3 kg).

Accessories

SUPPLIED: 1 x BNC free plug.

OPTIONAL: Board Extender TM 8710 for use with 100 MHz Multiplier.

Chapter 2

Operation

2.1 INSTALLATION

The space, in the basic counter, provided to accept the range unit is shown on the illustration in the TF 2401 manual. The unit is easily installed by locating it in its guide channel and pushing it slowly to the rear of the counter until it locks with its mating connectors. Once firmly in position, secure the unit using the locking screw provided at the bottom of the front panel.

2.2 CONTROLS AND CONNECTORS

ATTENUATOR switch. Selects the attenuation factor applied to the input signal.

Input connector (A channel). BNC socket for A input signal.

2.3 OPERATING PROCEDURE

Refer to the appropriate Function unit manual for the operating procedure.

Chapter 3

Technical description

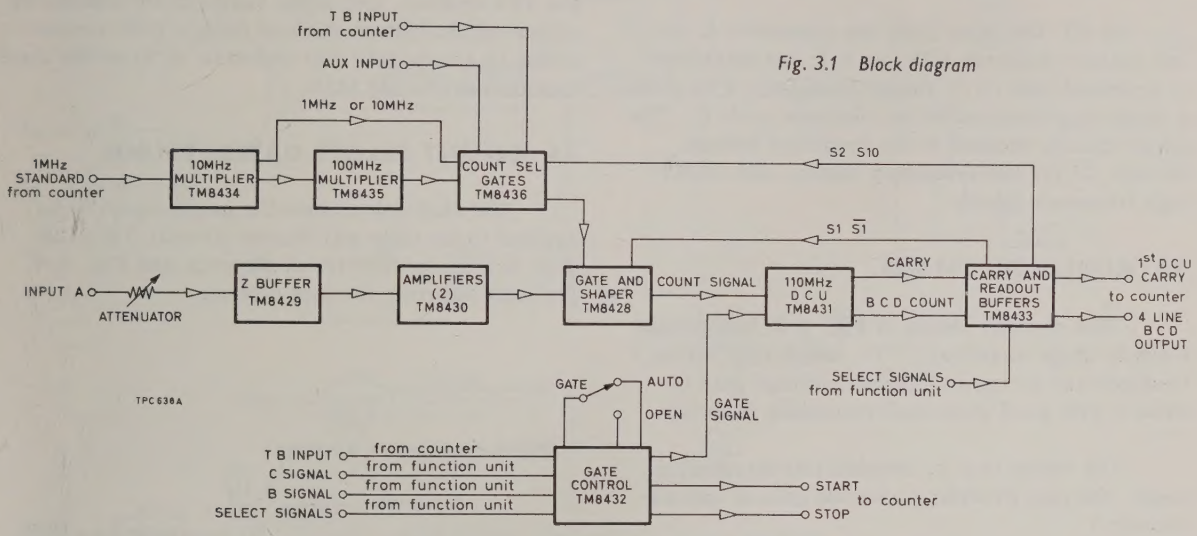


Fig. 3.1 Block diagram

3.1 SUMMARY

The basic block diagram for the circuit is shown in Fig. 3.1. TM 8428 selects either the A channel input or 1 MHz, 10 MHz, 100 MHz, time base or auxiliary input, as selected in TM 8436, and passes the signal to the 110 MHz DCU as the count signal. This signal is gated with the output from the gate control board, TM 8432, and used to trigger the DCU.

The 4-line BCD output from the DCU is passed to the display circuits in the main counter, and the carry signal triggers the next DCU, also in the counter.

3.2 LOGIC DEFINITIONS

Logic diagrams are used in this manual to help to give an understanding of the operation of the circuits, and to show how they are functionally interconnected.

Fig. 3.2 shows the logic symbols which are used in the descriptions of the various circuits. For further details see section 3.1 of the manual for Counter TF 2401A.

Fig. 6.8 at the back of this manual, shows the logic diagram for the complete counter system with range unit TM 8267 plugged in. Definitions of S (select) and F (function) signals are given in the manual for the function unit being used.

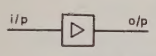
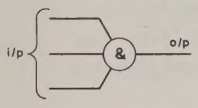
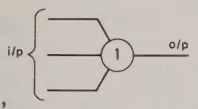
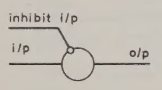
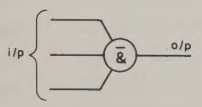
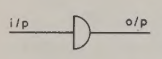
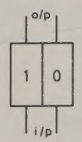
Symbol	Title	Definition
	amplifier	
	inverter	changes phase of input signal
	AND gate	all inputs must be in the '1' state (i.e. active) for the output to be in the '1' state.
	OR gate	one or more input in the '1' state will give a '1' state output.
	inhibit gate	the inhibit input in the '1' state prevents a '1' state output no matter what the state of the other input (or inputs).
	NAND gate	all inputs must be in the '0' state to give a '1' state output.
	delay	imposes a time delay on the input signal.
	bistable	a momentary signal on one input will set the corresponding output to the '1' state where it will remain until a signal is applied to the other input.

Fig. 3.2 Logic symbols

3.3 IMPEDANCE BUFFER: TM 8429

The circuit (see Fig. 6.3) forms a low gain, wide band amplifier with high input impedance and low output impedance.

At l.f. the input from the attenuator is fed into emitter follower VT1; at h.f. the transistor is bypassed with C1. Output transistor VT2 gives a slight improvement to the response as h.f. The output is a.c. coupled to the amplifier boards, through C4 for low frequency inputs, and C5 for high frequency inputs.

3.4 AMPLIFIER: TM 8430

This circuit, shown in Fig. 6.3, comprises a single stage amplifier, VT1, employing series feedback and giving an unloaded voltage gain of about 5 with good wide-band frequency response.

The output is a.c. coupled into an identical stage, the pair providing a loaded gain of approximately 7.

3.5 GATE AND SHAPER: TM 8428

This unit produces the count signal from either the A input or the input from TM 8436 (Count Select Gates); the selected signal is shaped and used to trigger the 110 MHz DCU. Fig. 6.2 shows the circuit for the unit and Fig. 3.3 the logic diagram.

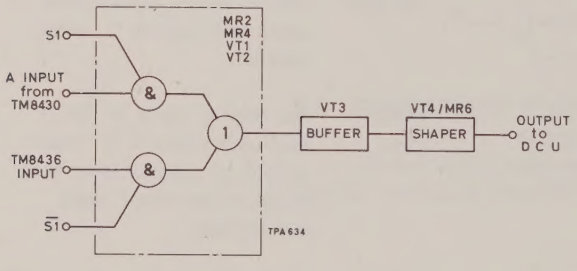


Fig. 3.3 Logic diagram for Gate and Shaper, TM 8428

An active S1 signal will select the A input from TM 8430, while an active $\overline{S1}$ signal will select the input from TM 8436, this latter signal being the time base, 1 MHz, 10 MHz, 100 MHz or the auxiliary input. The select signal is considered active when at approximately +6 V.

The selected output is a.c. coupled into emitter follower VT3 whose emitter voltage is maintained between close limits to achieve reliable tunnel diode driving.

MR6 and VT4 form a combined tunnel diode/transistor shaper which is used as the output stage. To ensure that MR6 gives sufficient base-emitter voltage to turn on VT4, the transistor is provided with pre-bias. This is effected by MR5 and R13 at the VT4 emitter, and at the tunnel diode cathode by a bias-adjust voltage derived from a 200Ω potentiometer in series with 75Ω (taken to -6 V) on the Gate Control board, TM 8432.

3.6 COUNT SELECT GATES: TM 8436

TM 8436 determines the count signal to be applied to the Gate and Shaper circuit, TM 8428. Fig. 6.6 shows the circuit diagram and Fig. 3.4 the logic diagram for this circuit.

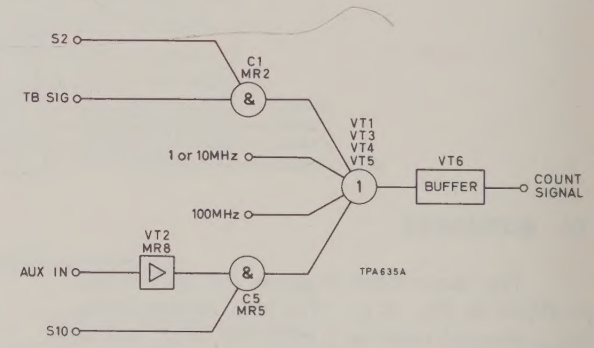


Fig. 3.4 Logic diagram for Count Select Gates, TM 8436

Transistors VT1, VT3, VT4 and VT5 form a four input OR gate, the inputs being 1 MHz or 10 MHz as selected in TM 8434, 100 MHz, time base signal and auxiliary input signal.

Before being fed to the OR gate the time base signal is gated with select signal S2 (time base select); S2 at +6 V being considered as active ('1' state) and at -4.5 V as inactive ('0' state).

The auxiliary input signal is similarly gated before being fed to the OR gate, but in this case it is amplified in VT2 in such a manner as to prevent small spurious signals from being passed to the gate. The gating signal in this instance is S10 (auxiliary input select).

The OR gate output is passed to emitter follower VT6 whose emitter load is located on the Gate and Shaper board, TM 8428.

3.7 GATE CONTROL: TM 8432

This unit selects the signals to control the opening and closing of the main counter gate.

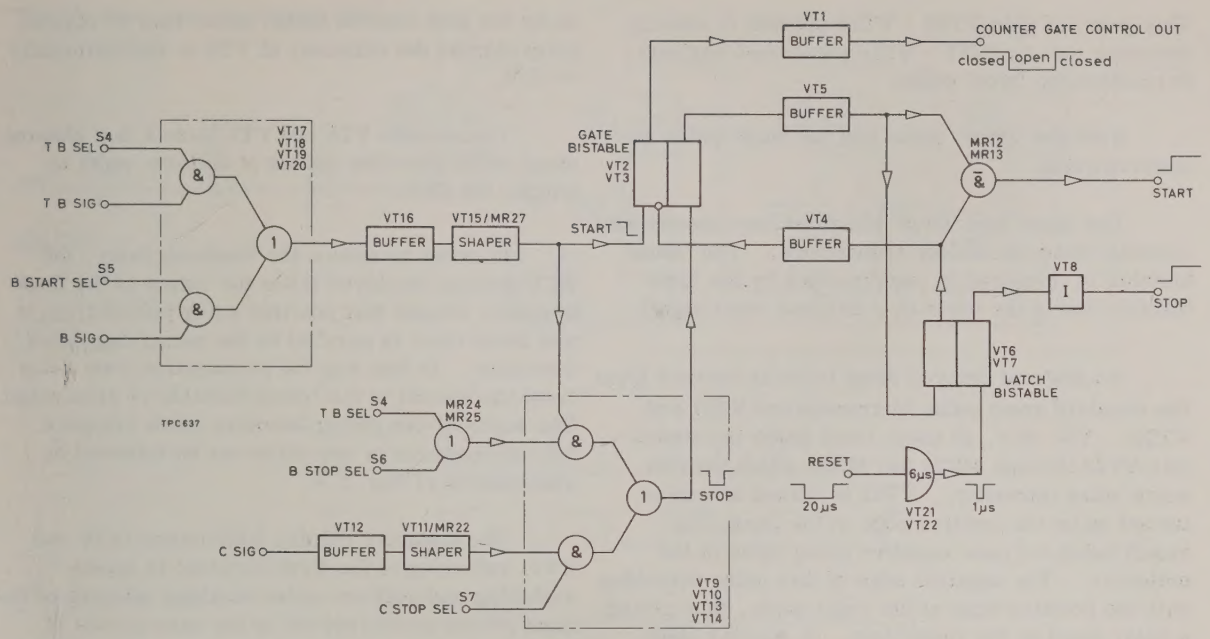


Fig. 3.5 Logic diagram for Gate Control, TM 8432

Logic

Fig. 3.5 shows the logic diagram for TM 8432.

A 'start' pulse is derived from the time base signal or the B input signal, either being selected by the appropriate S signal. The selected input is fed via a buffer to a shaper, the output of which sets the 'gate' bistable and opens an AND gate in the 'stop' pulse logic. (If S4 is present a 'stop' pulse will be produced but will have no effect on the 'gate' bistable as it is already in the reset state.) Setting the 'gate' bistable produces an 'open' condition at the counter gate control output. The reset side of the 'gate' bistable, being the '0' state, activates NAND gate MR12 - MR13 to produce a positive going 'start' signal (the other input to the gate is inactive owing to the 'latch' bistable being in the reset state).

A 'stop' pulse is derived from a time base signal or a B input signal, these being applied to the 'stop' pulse routing via pulse shaper VT15 - MR7, or a C input signal. The 'stop' signal resets the 'gate' bistable producing a counter gate closed condition; the reset output, via buffer VT5, closes the NAND gate and sets the 'latch' bistable. The reset output from the 'latch' bistable is inverted to produce a positive going 'stop' signal; the set output holds the NAND gate closed and imposes an inhibit on the 'gate' bistable, preventing any further change of state in that element.

The gate control unit will now remain in this state until a reset signal is applied; this signal resets the 'latch' bistable and the system is then ready to recycle. The reset pulse is delayed so that the 'gate' bistable will remain inhibited during and for a short time after the reset pulse, thus ensuring reliable operation of the unit.

Circuit

Fig. 6.7 shows the circuit diagram for this unit.

A 'start' signal is derived from a time base output or a B input signal as follows. The time base signal is applied to the collector of VT17; this transistor turns on, producing an output at the emitter only when a time base select signal (S4) holds off VT18. VT19 and VT20 select the B signal in an identical way. The resultant output signal is a.c. coupled into emitter follower VT16 and from there it is fed to the shaper formed by tunnel diode MR27 and transistor VT15; these two stages are similar to those in TM 8428, Gate and Shaper circuit. The 'start' output from VT15 is a 4 V negative going pulse of 70 nsec width.

A 'stop' signal is derived from the time base output, the B input signal or the C input signal.

The C signal is fed through an emitter follower and a shaping stage, which are identical to those mentioned above, to gating system VT9 - VT10.

This gate and gate VT13 - VT14 operate in exactly the same way as VT17 - VT18 (described earlier) to produce the 'stop' pulse.

Both the 'start' pulse and the 'stop' pulse are positive going.

The 'gate' and 'latch' bistables are conventional circuits using npn silicon transistors. The 'latch' bistable is triggered in one direction by the 'gate' bistable and in the other by a delayed reset signal.

An internal delayed reset pulse is derived from the standard reset pulse by transistors VT21 and VT22. The -6 V, 20 μsec reset pulse is coupled into VT22 through MR33 and MR34 which provide some noise immunity. VT22 is biased off and is turned on by the positive edge of the input, the result being a 6 μsec negative going pulse at the collector. The negative edge of this pulse coincides with the positive edge of the reset pulse, thus giving a delay equal to the reset time. A similar stage, VT21, is added to give a resultant 1 μsec negative going pulse 6 μsec after the end of the reset pulse; this 1 μsec pulse is used to reset the 'latch' bistable.

Manual operation is achieved by firmly clamping the two bistables in the 'gate shut' position, by applying a +6 V 'manual start' signal from the GATE switch to VT6 via MR16 and R17, and to VT4 via MR17 and R18.

Auxiliary circuits on the board are a +12 V regulator and the 100 MHz multiplier select gating.

The +12 V regulator comprises the series regulator VT26 and reference transistor VT25 connected between the counter -18 V reference supply and the +12 V output.

100 MHz multiplier gating is achieved by VT24 and VT23. The presence of either a 100 MHz T.I.M. select signal (S15) or a self check signal (F4) will turn off VT24 which allows VT23 to turn on. The resultant signal is fed to TM 8435 (100 MHz Multiplier) as the 100 MHz select signal.

3.8 110 MHz DECADE COUNTING UNIT: TM 8431

TM 8431 comprises the main counter gate and the high speed decade. Fig. 3.6 shows the logic diagram and Fig. 6.5 the circuit.

The signal to be counted is applied via emitter follower VT1 to transistor VT2 of the gate. Control of the gate is achieved by VT3 which, when turned on by the gate control signal (gate input or manual gate) clamps the collector of VT2 to approximately +0.5 V.

Transistors VT4 and VT5 form a fast shaping stage which provides pulses of uniform width to trigger the DCU.

In order to reduce the feedback delay, the DCU system employed takes the output of the first bistable, shapes fast positive going pulses from it and feeds them in parallel to the remaining three bistables. In this way the propagation time delay from the second to the fourth bistable is eliminated. The scale-of-ten gating becomes more complex, but the sequence of operation can be followed by examination of Fig. 3.6.

The bistables employ transistors (VT6 and VT9, referring to the first bistable) to speed switching and perform pulse routing; shaping of the input pulses is carried out in the base drives of these transistors. L7 and L9 resonate with stray capacitance to provide overshoot and hence a faster rise time on the bistable output waveform.

The second pulse shaping circuit comprises emitter follower VT10, squaring stage VT11 and the pulse shaping stages VT12 and VT13. Transistor VT11 is prevented from saturating by diode MR66, and narrow output pulse width is obtained by differentiating through C13 into VT12.

Feedback gating is achieved by clipping the positive differentiated edge from the bistable input, with diodes MR22, MR36, MR51, MR52 and MR53.

The BCD readout and carry signal outputs are buffered to the main counter by TM 8433.

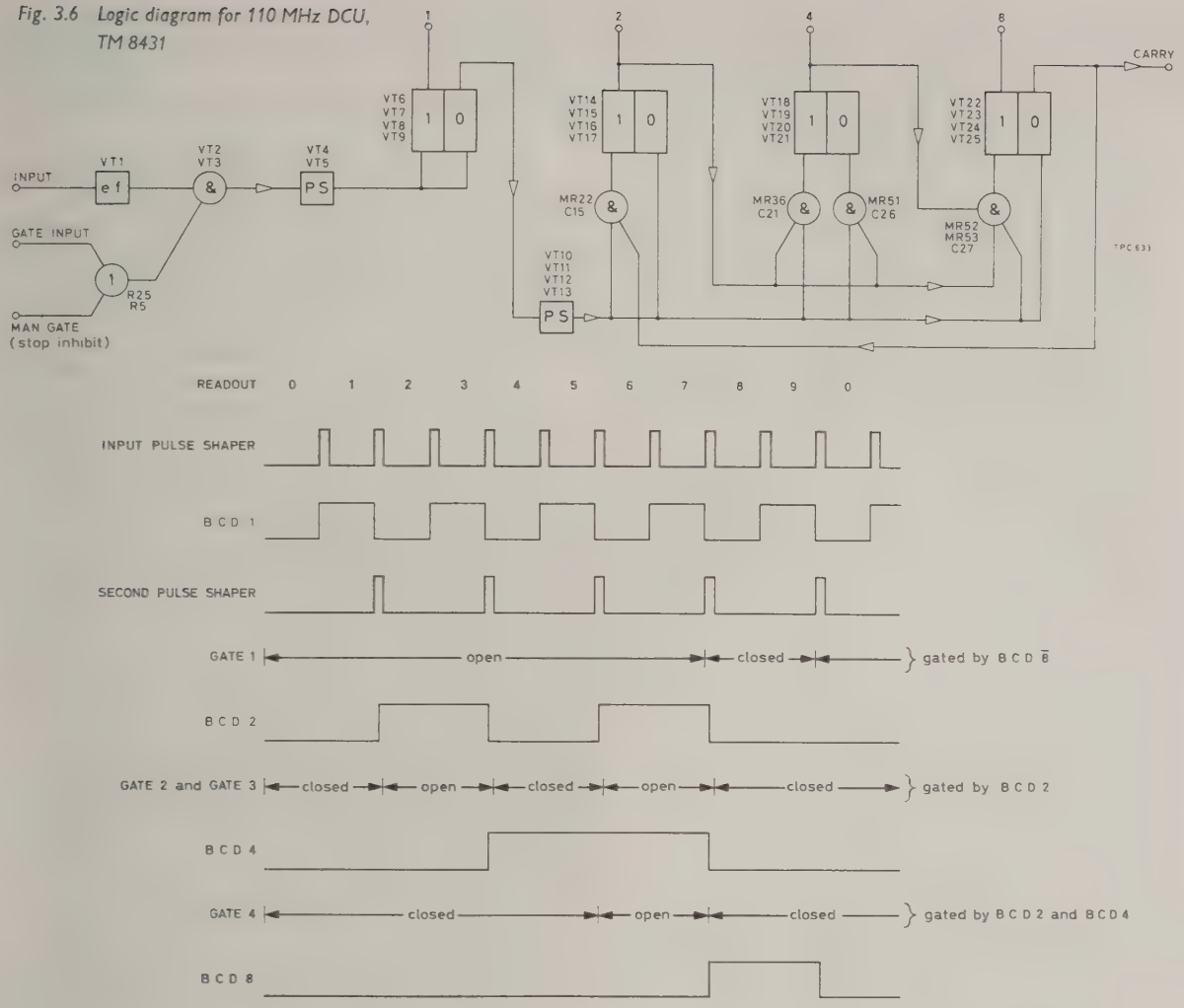
3.9 CARRY, RESET AND READOUT BUFFERS: TM 8433

TM 8433 adjusts input and output levels, where necessary, in order to maintain compatability between the 110 MHz Range unit, the main counter and function units. Fig. 6.6 shows the circuit diagram for this board.

VT1, the reset buffer, is triggered by the negative going 20 μsec wide reset pulse from the TF 2401 and produces the positive going 2 μsec pulse required to reset the high speed decade, TM 8431.

The carry buffer, VT2, inverts the negative going (+6 V to 0 V) output from the high speed

Fig. 3.6 Logic diagram for 110 MHz DCU, TM 8431



decade to give a positive going (-6 V to 0 V) output to the next DCU in TF 2401.

The four BCD output buffers are simple inverters which also adjust the voltage levels of the BCD drive to the counter. 0 V at the input turns on the transistor giving an output of -0.5 V; +6 V at the input turns off the transistor resulting in an output level of -9 V.

Select signals from the function unit, which operate the count selection gates (TM 8436) and the gate and shaper (TM 8428) also require altering in level; this is done by VT7, VT8, VT9 and VT10. The first three stages are identical in operation, but VT10 inverts the output of VT9 to give a $\overline{S1}$ signal. If the select signal is not required the input sees an open circuit and the transistors are biased on; an S signal provides a -6 V input which turns off the transistors.

3.10 10 MHz MULTIPLIER AND SELECT GATES: TM 8434

This circuit produces a 10 MHz signal from the 1 MHz standard and also selects 1 MHz or 10 MHz when either is required for time interval measurements. Fig. 3.7 shows the logic diagram for the select gating; the overall circuit is given in Fig. 6.4.

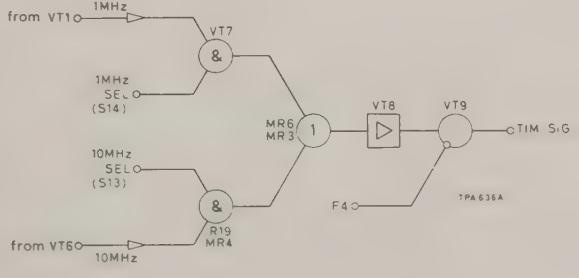


Fig. 3.7 Logic diagram for TIM select gating

The 1 MHz crystal oscillator output is fed into emitter follower VT1, the output of which drives the grounded emitter stage VT2; VT2 in turn drives the x5 multiplier VT3. C2 and R24 in parallel with the input impedance of VT3 provide the sharp pulses required to make circuit T1 - C3 resonate.

Transistor VT4 with T2 and C4 form the x2 multiplier. The following two stages amplify and buffer the 10 MHz output.

For time interval measurements either 1 MHz or 10 MHz signals may be required. AND gate VT7 selects 1 MHz; AND gate MR4 - R19 selects 10 MHz. During self checking a 100 MHz clock signal is required and so the TEST function signal, F4, is used to impose an inhibit on the selected T.I.M. signal via transistor VT9. F4 present, at -6 V, turns on VT9 thus holding the collector of VT8 at earth.

3.11 100 MHz MULTIPLIER: TM 8435

Fig. 6.4 shows the circuit diagram for this board. The 10 MHz input from the 10 MHz multiplier is amplified and squared in VT1. The output from this transistor is fed via differentiating circuit C3 - MR1 to the x5 multiplier VT2; the resultant sharp pulse causes tuned circuit C1 - T1 to resonate.

VT3 amplifies the tuned circuit output, producing a level sufficient to drive the x2 multiplier, VT4. Transistor VT5 amplifies the 100 MHz from VT4 and drives the output emitter follower VT6; the emitter load of VT6 is mounted on TM 8436 (Count Select Gates).

Chapter 4

Maintenance

4.1 GENERAL

This section of the manual is intended as a general guide to the servicing of the unit. In case of difficulties which cannot be resolved with the aid of this book, please contact our Service Division at the address on the rear cover, or your nearest Marconi Instruments representative. Always mention the type number and serial number of your unit.

If it is found necessary to check the performance of the unit, this should be done in conjunction with a TF 2401 series counter and a function unit, both of which are working correctly. All adjustments should be made with the cover removed from the counter.

4.2 ACCESS TO CIRCUIT BOARDS

Remove the screw in the top rear of the Range unit; this allows removal of the top cover. Fig. 4.1 shows the distribution of the boards now made available.

TM 8436, TM 8435 and TM 8434

These boards are each housed in a screening box. Each box is secured by a screw in the side of the unit, near the top. Removing this screw releases the box which can then be removed with the board.

TM 8428, TM 8429 and TM 8430

These boards, together with the attenuator, are housed in the front section of the Range unit, behind the front panel.

Should a fault occur on any board in this assembly, it is recommended that the unit be returned to our Service Division for repair. Should you, however, decide to service the unit yourself, the servicing must be carried out only by qualified personnel.

CAUTION Do not unplug the front section when the range unit is in the counter and it is switched on. To do so will result in damage to the amplifier transistors owing to their emitter loads being mounted inside the main unit.

The front section can be unplugged by removing the locking screw (held by a 'C' washer at the rear of the unit) and the four screws, two on each side, nearest the front of the unit.

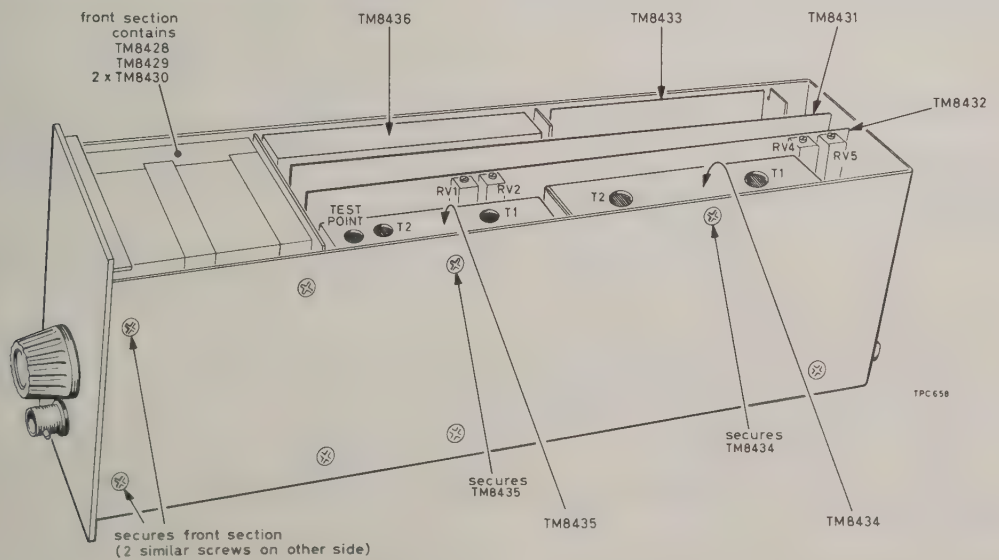


Fig. 4.1 General view of the unit

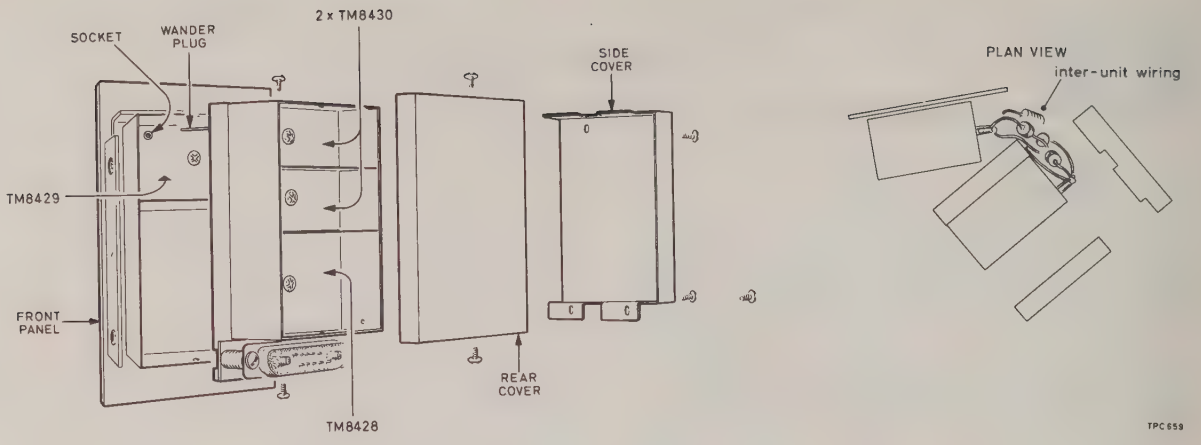


Fig. 4.2 Exploded view of front section of the unit

To gain access to components on the two amplifier boards (TM 8430) and the gate and shaper board (TM 8428) remove the outer screening lid. Fig. 4.2 shows an exploded view of the front section.

The impedance buffer components and the attenuator are made available by first removing the side plate which covers the feed through capacitors, and then the two screws, one in the top and the other in the bottom of the assembly. The section containing the amplifiers etc., can now be hinged to the side; care must be taken to avoid breaking wire connections. Removing the plate (held by five screws) in the rear of the hinged-back section gives access to the printed wiring on the gate and shaper board.

When replacing this part of the assembly ensure that the wander plug locates in its socket before pushing the section into place.

4.3 TEST EQUIPMENT

The following test equipment is required to perform the adjustments detailed in subsequent sections.

a) Oscilloscope; capable of displaying waveforms with a repetition rate of up to 100 MHz.

b) D. C. Voltmeter; range approximately 40 V, minimum accuracy 5% e.g. Marconi Instruments TF 1041C, or TF 2604.

4.4 ADJUSTING THE 12 V REGULATED SUPPLY

(1) Remove the top cover from the unit and insert the unit into the counter.

(2) Remove TM 8432, Gate Control board, insert Extender board TM 7892 in its place and then insert the gate control board into the extender. Make sure that the board is oriented correctly.

(3) Set the counter SUPPLY switch to COUNTER.

(4) Set the voltmeter controls for a range of approximately 40 V. Connect the negative lead to the counter chassis and the positive lead to pin 3 of the connector nearest the rear of the counter (shown as (3) in the interconnecting diagram).

(5) Adjust RV4 for a meter reading of +12 V.

4.5 ADJUSTING THE 10 MHz MULTIPLIER

(1) Remove the top cover from the unit, and remove the screening box from the 10 MHz Multiplier, TM 8434. Insert the unit into the counter.

(2) Insert Extender board TM 7893 in place of the Multiplier board and then insert the board into the extender. Make sure that the board is oriented correctly.

(3) Set the counter SUPPLY switch to COUNTER, and the FUNCTION switch to TEST.

(4) Set the oscilloscope controls for 5V/cm, 2 μsec/cm and internal triggering.

(5) Connect the oscilloscope earth lead to the range unit chassis, and the oscilloscope probe to the collector of VT3 of the multiplier (see Fig. 6.4).

(6) Adjust T1 to obtain a damped sinusoidal waveform of 5 MHz. When peaked, the waveform should have an amplitude of approximately 6 V p-p.

(7) Move the oscilloscope probe to the collector of VT5, and adjust T2 to obtain a maximum amplitude 10 MHz signal.

(8) Switch off, and replace the multiplier board, its cover and the top cover of the unit. Reinsert the unit into the counter, and switch on again.

(9) Connect the oscilloscope earth lead to the counter chassis, and the oscilloscope probe to the 10 MHz OUT connector on the rear of the counter.

(10) Readjust T1 and T2 to obtain a peak, undistorted 10 MHz waveform. T1 and T2 are accessible through openings in the top cover of the range unit.

4.6 ADJUSTING THE 100 MHz MULTIPLIER

(1) Remove the top cover from the unit, and remove the screw holding the 100 MHz multiplier in place. Insert the unit into the counter.

(2) Remove the multiplier and insert a TM 8710 Extender board.

(3) Remove the lid of the multiplier's screening box, and insert the board into the extender board. Make sure that it is oriented correctly.

(4) Set the counter SUPPLY switch to COUNTER.

(5) Set the oscilloscope controls for 2 V/cm, 10 nsec/cm and internal triggering.

(6) Connect the oscilloscope earth lead to the range unit chassis, and connect the oscilloscope probe to the collector of VT3 of the 100 MHz multiplier (see Fig. 6.4).

(7) Adjust T1 to obtain a 50 MHz damped sinusoidal waveform. When peaked the waveform should have an amplitude of approximately 4 V p-p.

(8) Connect the oscilloscope probe to the test point on the board and adjust T2 to obtain a maximum amplitude 100 MHz signal.

(9) Switch off, and replace the multiplier board, its cover and the top cover of the unit. Reinsert the unit into the counter and switch on again.

(10) Connect the oscilloscope earth lead to the Range unit chassis, and the oscilloscope probe to the test point on the multiplier. (The test point and T1 and T2 are accessible through openings in the top cover of the unit).

(11) Readjust T1 and T2 on the 100 MHz multiplier board to obtain a peak, undistorted 100 MHz waveform. When peaked, the waveform should have an amplitude of approximately 2 V p-p.

4.7 BIAS ADJUSTMENT

(1) Set the counter and function unit controls as follows:

SUPPLY switch to COUNTER
FUNCTION switch to TEST
DISPLAY control fully counter clockwise
GATE switch to AUTO

(2) Starting at the extreme counter clockwise position, turn the counter TIME BASE switch five positions clockwise.

(3) While observing the counter display, adjust variable resistor RV3 of the Gate Control (TM 8432) to obtain a readout of 100 000 (kHz) ±1 count.

(4) Set the counter TIME BASE switch to the other positions in turn. The 100 MHz reading ±1 count should be obtained on all positions except where overflow occurs. Readjust RV3 if necessary to obtain this reading.

4.8 FACTORY ADJUSTMENTS

The Gate Control, TM 8432, has two additional variable resistors, RV1 and RV2. These are adjusted during test in the factory and must not be changed in the field.

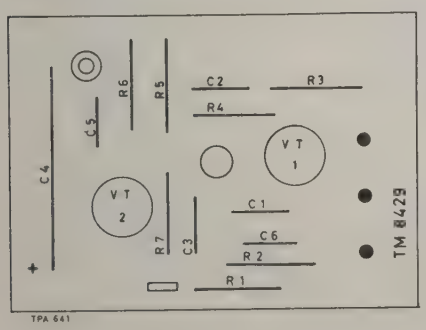


Fig. 4.3 Component layout: Impedance Buffer, TM 8429

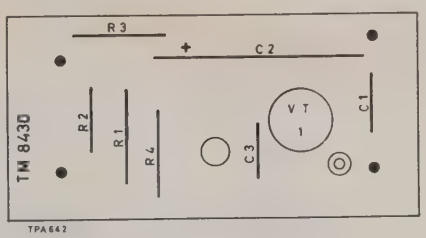


Fig. 4.4 Component layout: Amplifier, TM 8430

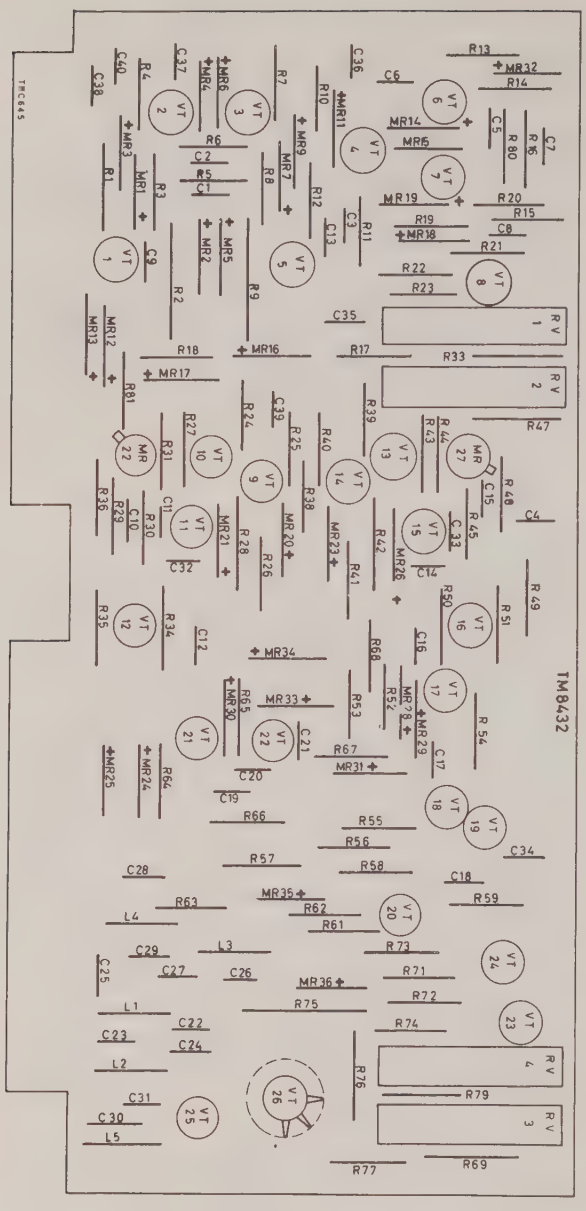


Fig. 4.5 Component layout: Gate Control, TM 8432

Fig. 4.5. Reverse the polarity of all diodes except MR14.

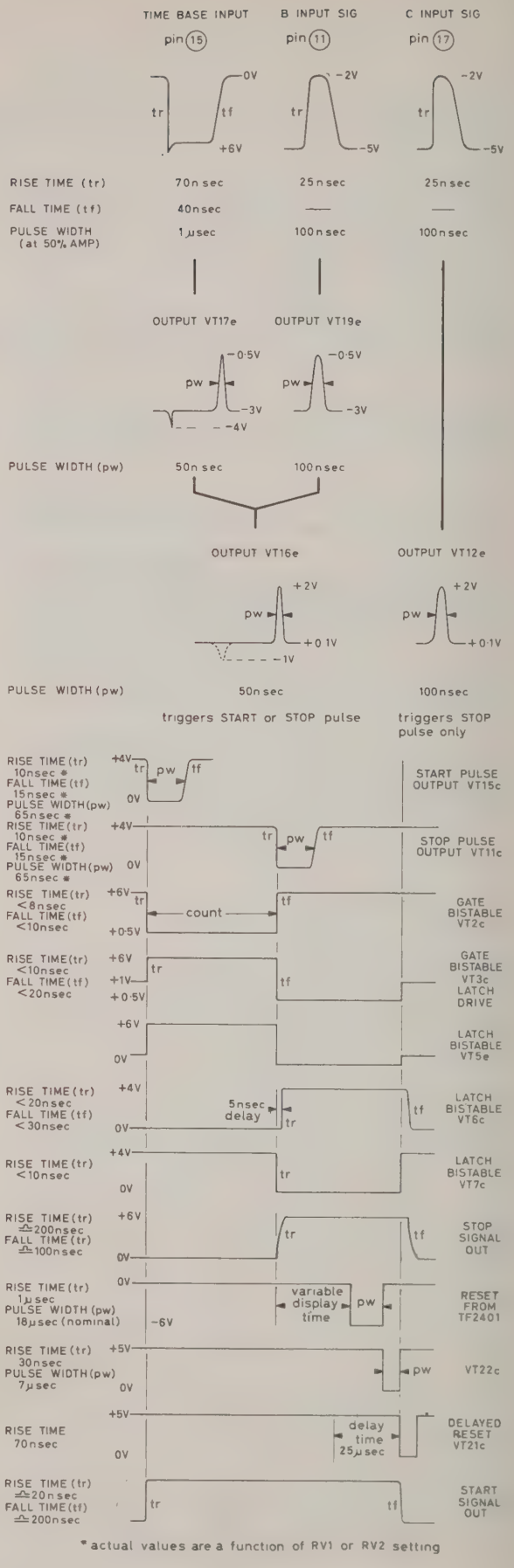
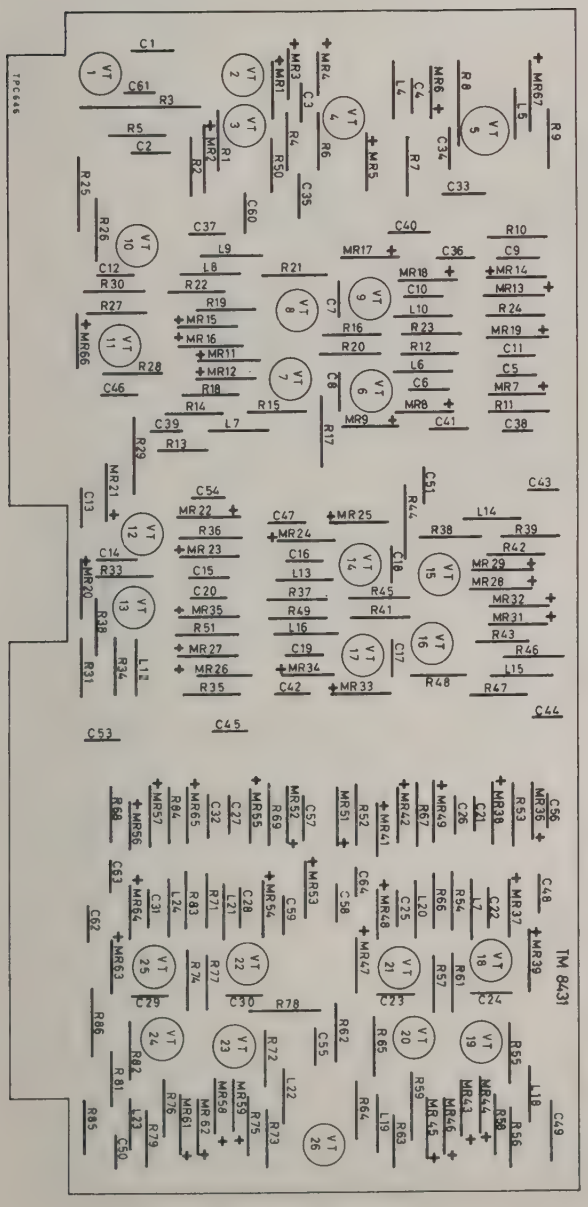
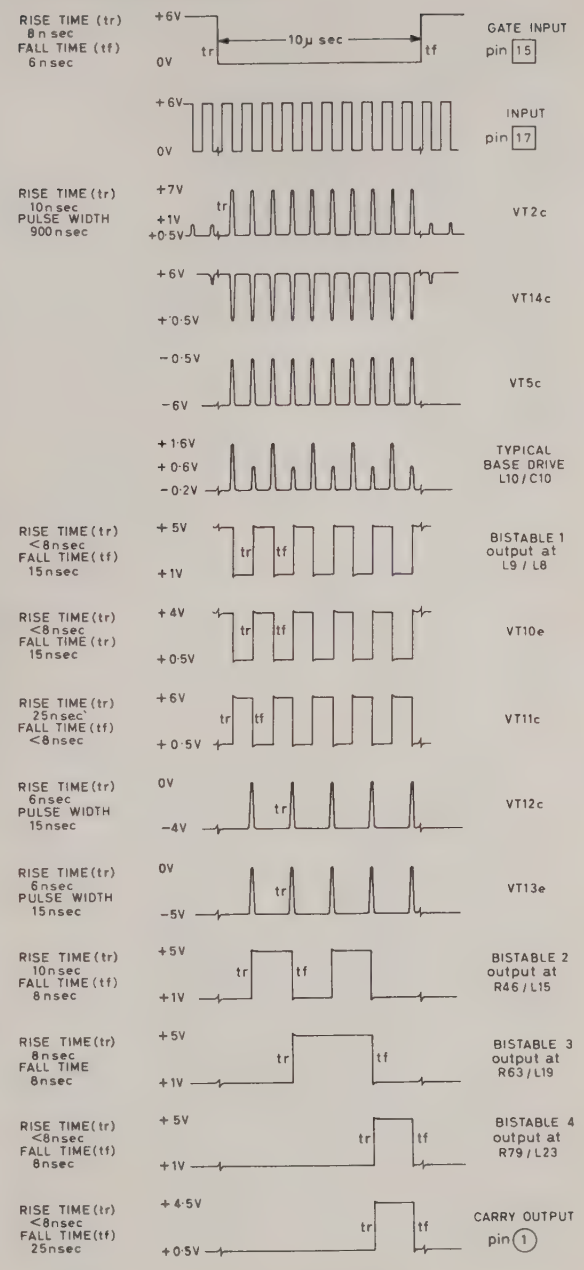


Fig. 4.6 Gate control waveforms showing timing of signals

Fig. 4.7 110 MHz DCU waveforms showing timing of pulses



LOW FREQUENCY PERFORMANCE



1 input frequency 1MHz

2 counter reads 10MHz i.e. count of ten

3 output loaded by TM8433 (carry, reset and readout buffers)

Fig. 4.8 Component layout: 110 MHz DCU, TM 8431

Fig. 4.8. Reverse the polarity of all diodes.

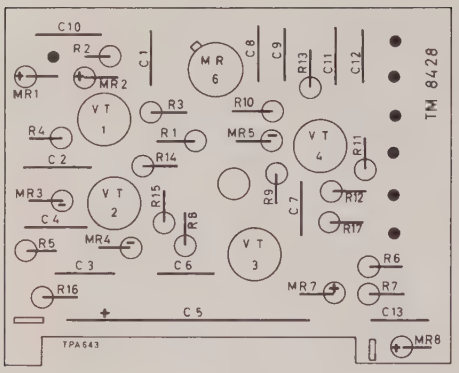


Fig. 4.9 Component layout: Gate and Shaper, TM 8428

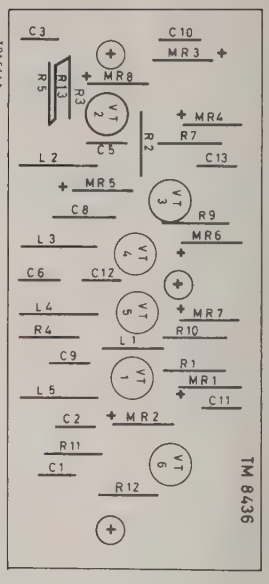


Fig. 4.11 Component layout: Count Select Gates, TM 8436

(a) INPUT FROM TM8430

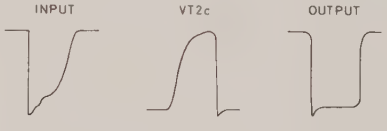
FREQ	INPUT Vp-p	VT1c Vp-p	OUTPUT Vp-p	w/f	RISE TIME
10Hz	1·5V	6V	>5·5V	SQUARE	≏10 n sec
1MHz	1V	3·5V	>5·5V	SQUARE	<20 n sec
10MHz	1V	3V	>5·5V	SQUARE	<20 n sec
50MHz	0·5V	1·5V	3V	SINE	—
110MHz	280mV	460mV	480mV	SINE	—

(b) INPUT FROM TM8436

1. TIME BASE OUTPUT selected by TM8436

RISE TIME	10 n sec	20 n sec	10 n sec
PULSE WIDTH (at 50% AMP)	75 n sec	100 n sec	100 n sec
DELAY TIME	50 n sec	10 n sec	15 n sec
AMPLITUDE	2Vp-p	2Vp-p	>5·5Vp-p

2. 1MHz or 10MHz CLOCK selected by TM8436



RISE TIME	10 n sec	10 n sec	15 n sec
PULSE WIDTH (at 50% AMP)	35 n sec	50 n sec	75 n sec
DELAY TIME	—	20 n sec	15 n sec
AMPLITUDE	2Vp-p	2·5Vp-p	>5·5Vp-p

3. 100MHz CLOCK selected by TM8436

	INPUT	OUTPUT
	SINE WAVE	SINE WAVE
AMPLITUDE	200mVp-p	500mVp-p

(c) DC LEVELS

VT1 / VT2c	VT3e	VT4e
+8Vp-p	≏0Vp-p	≏0·5Vp-p

Fig. 4.10 Gate and shaper

TYPICAL PERFORMANCE DATA (loaded output)

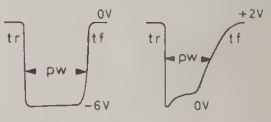
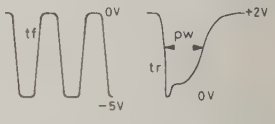
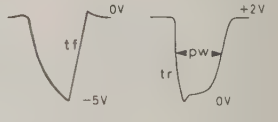
	FUNCTION	INPUT	OUTPUT (A1)
	TIME BASE S16 pin (3)		
RISE TIME (tr)		≏70 n sec	10 n sec
FALL TIME (tf)		30 n sec	—
PULSE WIDTH (pw)		1 μ sec	80 n sec
	1MHz CLOCK pin A1		
RISE TIME (tr)		—	8 n sec
FALL TIME (tf)		≏10 n sec	—
PULSE WIDTH (pw)		—	20 n sec
	10MHz CLOCK pin A1		
RISE TIME (tr)		—	8 n sec
FALL TIME (tf)		10 n sec	—
PULSE WIDTH (pw)		—	28 n sec
	100MHz CLOCK pin (A2)	SINE WAVE	SINE WAVE
AMPLITUDE		1Vp-p	700mV

Fig. 4.12 Count select gates

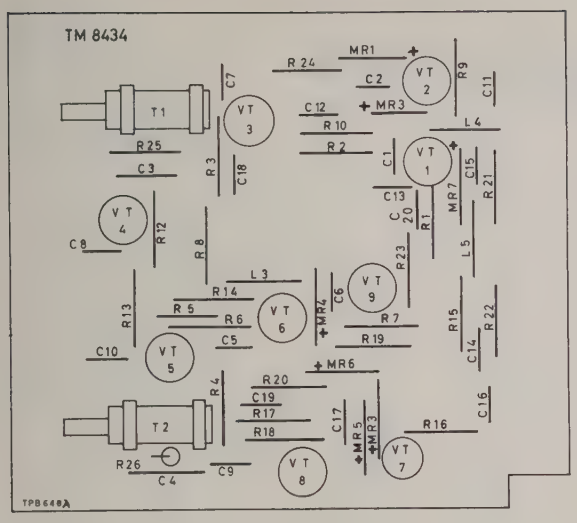


Fig. 4.13 Component layout: 10 MHz Multiplier and Select Gates, TM 8434

MULTIPLIER INPUT 1Vrms 1MHz SINE WAVE
(min output 700mVrms)

RISE TIME	50nsec	10nsec
FALL TIME	100nsec	10nsec
PULSE WIDTH	0·3μsec	30nsec
AMPLITUDE	5Vp-p	4Vp-p
p.r.f.	——	10MHz

SELECT GATING OUTPUT VT8c

PULSE WIDTH	——	0·3μsec
AMPLITUDE	5Vp-p	5Vp-p

Fig. 4.15 10 MHz multiplier

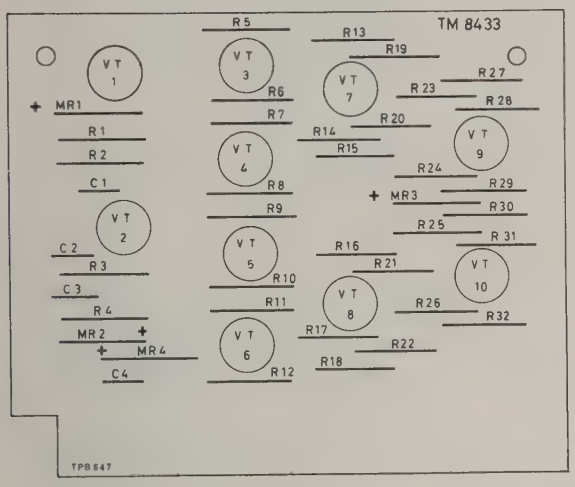


Fig. 4.14 Component layout: Carry, Reset and Readout Buffers, TM 8433

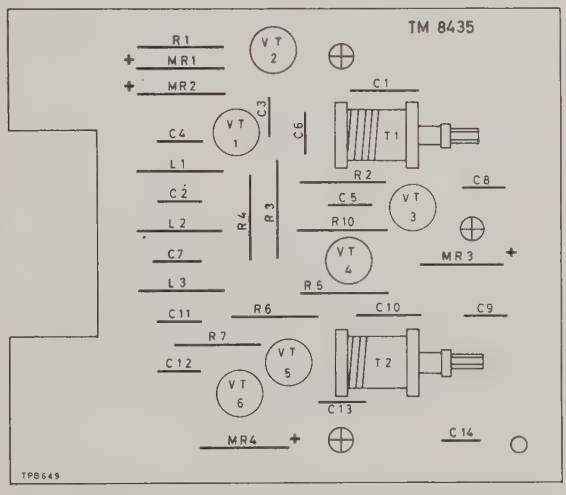


Fig. 4.16 Component layout: 100 MHz Multiplier, TM 8435

Chapter 5

Replaceable parts

Introduction

The instrument consists of a number of sub-assemblies, each of which is allocated an identity number in the sequence A0 to A11 inclusive, as follows:-

A0	Main chassis
A1	Gate and shaper
A2	Amplifier
A3	Amplifier
A4	Impedance buffer
A5	10 MHz multiplier and select gates
A6	100 MHz multiplier
A7	100 MHz DCU
A8	Carry and readout buffer
A9	Count select gate
A10	Gate control
A11	Input amplifier

The complete reference of a part consists of the sub-assembly number followed by its circuit reference, e.g., A4C5, A7R4, etc., and this should always be stated on any order, letter, etc. For convenience in the text and on circuit diagrams, the circuit reference is abbreviated by dropping the sub-assembly prefix except where there is risk of ambiguity.

Replaceable parts are grouped in order of sub-assembly designation and itemized in alphanumerical order of circuit references, with miscellaneous parts at the end of each list. The following abbreviations are used:-

C	:	capacitor
Carb	:	carbon
Cer	:	ceramic
Elec	:	electrolytic
FS	:	fuse
ILP	:	illumination lamp
JK	:	jack
L	:	inductor
Log	:	logarithmic law
M	:	meter
Met	:	metal
Min	:	minimum value
MR	:	semiconductor diode
Ox	:	oxide
PL	:	plug
Plas	:	plastic
PLP	:	pilot lamp
R	:	resistor
RV	:	variable resistor
S	:	switch
SKT	:	socket
T	:	transformer
TE	:	total excursion
TH	:	thermistor
TP	:	terminal
V	:	valve
Var	:	variable or preset
VT	:	transistor
WW	:	wirewound
X	:	ferrite bead
†	:	value selected during test; nominal value listed
ϕ	:	feed-through component
W	:	watts at 70°C
W*	:	watts at 55°C
W**	:	watts at 40°C
W***	:	watts at 20°C
W°	:	watts at unspecified temperature

Ordering

Orders for replacement parts should be sent to our Service Division at the address on the back cover. Specify the following information for each part required:

1) Type and serial number of instrument.

2) Circuit reference.

3) Description.

4) M.I. code number.

If a part is not listed state its function, location and description when ordering.

Semiconductor types

The M.I. code listed against each diode or transistor refers, generally, to more than one type of semiconductor. These types are listed overleaf against the M.I. code number.

DIODES

91003: CMC4300120; 1N34A/G; 1N34; 1N34AS.
91004: CMC4300141; S3237G; CTP309.
91006: CMC4300158; U16003; 1N3063; FD1059; D3587;
91007: CMC4300160: S555G; 1N995; HD1870.
91008: CMC4300180; CDG1093; 1N4524.
92006: CMC4300148; HC-68; SD-2; SS-819.
93007: CMC4300183; 1N2941A.

TRANSISTORS

94005: CMC4906096; 2N3012.
95008: CMC4906009; 2N404.
95010: CMC4906041; SM644; 3862.
95016: CMC4906065; SM2035.
95511: CMC4906038; U16004; 2N708; S5900; 3583; CET246.
95512: CMC4906043; U16005; SM4998; TI484.
95513: CMC4906045; U16006; 2N709; 4051.
95515: CMC4906071; U16008; SM5902; 4065; CET247.
95516: CMC4906072; U16009; 2N2369; CET248; SM4237.

A0— Main chassis

When ordering, prefix circuit reference with A0.

Circuit reference	Description	M.I. code
C101	Plas 330pF ±2pF 125V	26516-369
C102	Elec 2.2µF ±20% 20V	26482-245
C103	Cer 4.7pF ±0.25pF	26324-017
L101	0.24mH ±10%	23010-033
PL102	36 way	23435-417
PL136	Coaxial	23443-020
PL137	Coaxial	23443-020
PL138	Coaxial	23443-020
PL139	Coaxial	23443-020
R101	Carb 220Ω ±5% ¼W	24332-058
R102	Carb 58Ω ±5% ¼W	24332-043
R103	Carb 33Ω ±10% ¼W	24341-233
SKT101	10 way	23435-270

For symbols and abbreviations see introduction to this chapter

A1— Gate and Shaper, TM 8428

When ordering, prefix circuit reference with A1.

Circuit reference		Description	M.I. code
C1	Cer	0.1μF +80% -20% 12V	26382-214
C2	Cer	50pF ±10% 500V	26383-172
C3	Cer	0.1μF +80% -20% 12V	26382-214
C4	Cer	390pF ±10% 500V	26383-217
C5	Cer	100μF ±20% 10V	26488-234
C6	Cer	0.1μF +80% -20% 12V	26382-214
C7	Cer	12pF ±5% 500V	26343-341
C8	Cer	0.1μF +80% -20% 12V	26383-214
C9	Cer	0.1μF +80% -20% 12V	26383-214
C10	Cer	0.1μF +80% -20% 12V	26383-214
C11	Cer	0.1μF +80% -20% 12V	26383-214
C12	Cer	0.1μF +80% -20% 12V	26383-214
C13	Cer	0.1μF +80% -20% 12V	26383-214

MR1	Silicon planar	MIP 91006
MR2	High speed	MIP 91008
MR3	Silicon planar	MIP 91006
MR4	High speed	MIP 91008
MR5	Medium voltage	MIP 92006
MR6	Tunnel	MIP 93007
MR7	High speed	MIP 91008
MR8	Silicon planar	MIP 91006

R1	Carb	1.5kΩ ±5% 1/10W	24331-284
R2	Carb	1.2kΩ ±5% 1/10W	24331-282
R3	Carb	390Ω ±5% ¼W	24332-665
R4	Carb	47Ω ±5% 1/10W	24331-237
R5	Carb	68Ω ±5% ¼W	24332-643
R6	Carb	3.9kΩ ±5% 1/10W	24331-296
R7	Carb	2kΩ ±5% 1/10W	24331-287
R8	Carb	510Ω ±5% ¼W	24332-670
R9	Carb	220Ω ±5% ¼W	24332-658
R10	Carb	7.5Ω ±5% 1/10W	24331-217

When ordering, prefix circuit reference with A1.

Circuit reference		Description	M.I. code
R11	Carb	270Ω ±5% ¼W	24332-661
R12	Carb	220Ω ±5% ¼W	24332-658
R13	Carb	120Ω ±10% ½W°	24010-021
R14	Carb	1.5kΩ ±5% 1/10W	24331-284
R15	Carb	1.2kΩ ±5% 1/10W	24331-282
R16	Carb	10Ω ±5% 1/10W	24331-220
R17	Carb	1.5kΩ ±5% 1/10W	24331-284

VT1	High speed, planar	MIP 95516
VT2	High speed, planar	MIP 95516
VT3	High speed, planar	MIP 95516
VT4	Ultra high speed, planar	MIP 95513

A2— Amplifier, TM 8430

When ordering, prefix circuit reference with A2.

C1	Cer	0.1μF +80% -20% 12V	26382-214
C2	Elec	100μF ±20% 10V	26488-234
C3	Cer	50pF ±10%	26383-172

R1	Carb	3.9kΩ ±5% 1/10W	24331-296
R2	Carb	1.2kΩ ±5% 1/10W	24331-282
R3	Carb	270Ω ±5% 1/10W	24331-261
R4	Carb	39Ω ±5% 1/10W	24331-235

VT1	Ultra high speed - planar	MIP 95513

For symbols and abbreviations see introduction to this chapter

A3— Amplifier, TM 8430

When ordering, prefix circuit reference with A3.

Circuit reference	Description	M.I. code
	The components on this unit are identical to those on unit A2.	

A4— Impedance Buffer, TM 8429

When ordering, prefix circuit reference with A4.

C1	Cer 10pF ±5%	26343-337
C2	Cer 22pF ±10% 500V	26343-360
C3	Cer 50pF ±10%	26383-172
C4	Elec 100µF ±20% 10V	26488-234
C5	Cer 0.1µF +80% -20% 12V	26382-214
C6	Cer 5pF ±0.5pF	26343-306
R1	Carb 12kΩ ±5% 1/10W	24331-312
R2	Carb 1.5kΩ ±5% 1/10W	24331-284
R3	Carb 1kΩ ±5% 1/10W	24331-280
R4	Carb 820Ω ±5% 1/10W	24331-218
R5	Carb 2.4kΩ ±5% 1/10W	24331-289
R6	Carb 300Ω ±5% ¼W	24332-662
R7	Carb 270Ω ±5% 1/10W	24331-261
SKT	(PW) Wander	23421-087
VT1	High frequency - planar	MIP 95515
VT2	Ultra high speed - planar	MIP 95513

A5—10 MHz Multiplier and Select Gates, TM 8434

When ordering, prefix circuit reference with A5.

Circuit reference	Description	M.I. code
C1	Cer 470pF ±10% 500V	26383-222
C2	Cer 10pF ±5% 500V	26343-337
C3	Cer 560pF ±10% 500V	26383-227
C4	Cer 200pF ±10% 500V	26383-196
C5	Cer 75pF ±10% 500V	26383-181
C6	Cer 0.02µF +50% -25% 12V	26383-007
C7	Cer 0.02µF +50% -25% 12V	26383-007
C8	Cer 0.001µF +40% -20% 500V	26383-242
C9	Cer 0.02µF +50% -25% 12V	26383-007
C10	Cer 470pF ±10% 500V	26383-222
C11	Cer 0.1µF +80% -20% 12V	26382-214
C12	Cer 0.1µF +80% -20% 12V	26382-214
C13	Cer 300pF ±10% 500V	26383-211
C14	Cer 0.1µF +80% -20% 12V	26382-214
C15	Cer 0.1µF +80% -20% 12V	26382-214
C16	Cer 0.1µF +80% -20% 12V	26382-214
C17	Cer 150pF ±10% 500V	26383-193
C18	Cer 0.1µF +80% -20% 12V	26382-214
C19	Cer 0.1µF +80% -20% 12V	26382-214
C20	Cer 470pF ±10% 500V	26383-222
L3	6.8µH ±10%	23010-029
L4	82µH ±10%	23010-031
L5	82µH ±10%	23010-031
MR1	General purpose	MIP 91003
MR3	General purpose	MIP 91003
MR4	Silicon planar	MIP 91006
MR5	General purpose	MIP 91003
MR6	Silicon planar	MIP 91006
MR7	General purpose	MIP 91003
MR8	General purpose	MIP 91003

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A5.

Circuit reference	Description	M.I. code
R1	Carb 1kΩ ±5% 1/10W	24331-280
R2	Carb 12kΩ ±5% 1/10W	24331-312
R3	Carb 1kΩ ±5% 1/10W	24331-280
R4	Carb 1kΩ ±5% 1/10W	24331-280
R5	Carb 430Ω ±5% 1/10W	24331-267
R6	Carb 2.7kΩ ±5% 1/10W	24331-292
R7	Carb 510Ω ±5% 1/10W	24331-270
R8	Carb 180Ω ±5% ¼W	24332-056
R9	Carb 10kΩ ±5% 1/10W	24331-310
R10	Carb 1kΩ ±5% 1/10W	24331-280
R12	Carb 2.2kΩ ±5% 1/10W	24331-288
R13	Carb 1kΩ ±5% 1/10W	24331-280
R14	Carb 6.8kΩ ±5% 1/10W	24331-306
R15	Carb 15kΩ ±5% 1/10W	24331-314
R16	Carb 270Ω ±5% ¼W	24332-061
R17	Carb 180Ω ±5% ¼W	24332-056
R18	Carb 12kΩ ±5% 1/10W	24331-312
R19	Carb 270Ω ±5% ¼W	24332-061
R20	Carb 2.2kΩ ±5% 1/10W	24331-288
R21	Carb 10kΩ ±5% 1/10W	24331-310
R22	Carb 1.5kΩ ±5% 1/10W	24331-284
R23	Carb 510Ω ±5% 1/10W	24331-270
R24	Carb 470Ω ±5% 1/10W	24331-269
R25	Carb 10kΩ ±5% 1/10W	24331-310
R26	Carb ~~3.3~~1kΩ ±5% 1/10W	24331-~~294~~ 270
T1		43567-006
T2		43563-002
VT1	High speed - epitaxial	MIP 95010
VT2	High speed - planar	MIP 95511
VT3	High speed - epitaxial	MIP 95010
VT4	High speed - epitaxial	MIP 95010
VT5	High speed - epitaxial	MIP 95010
VT6	High speed - epitaxial	MIP 95010
VT7	High speed - epitaxial	MIP 95010
VT8	High speed - epitaxial	MIP 95010
VT9	General purpose	MIP 95008

A6— 100 MHz Multiplier, TM 8435

When ordering, prefix circuit reference with A6.

Circuit reference	Description	M.I. code
C1	Plas 60pF ±2pF 500V	26516-189
C2	Cer 0.1µF +80% -20% 12V	26382-214
C3	Cer 10pF ±10% 500V	26343-338
C4	Cer 390pF ±10% 500V	26383-217
C5	Cer 15pF ±5% 500V	26343-345
C6	Cer 0.1µF +80% -20% 12V	26382-214
C7	Cer 0.05µF +80% -20% 25V	26010-029
C8	Cer 220pF +40% -20% 500V	26383-206
C9	Cer 0.1µF +80% -20% 12V	26382-214
C10	Plas 30pF ±2pF 125V	26516-117
C11	Cer 0.1µF +80% -20% 12V	26382-214
C12	Cer 0.1µF +80% -20% 12V	26382-214
C13	Cer 15pF ±5% 500V	26343-345
C14	Cer 50pF ±10% 500V	26383-172
L1	0.24mH ±10%	23010-033
L2	0.24mH ±10%	23010-033
L3	0.24mH ±10%	23010-033
MR1	Silicon planar	MIP 91006
MR2	Silicon planar	MIP 91006
MR3	High speed	MIP 91008
MR4	High speed	MIP 91008
R1	Carb 1kΩ ±5% 1/10W	24331-280
R2	Carb 330kΩ ±5% ¼W	24332-663
R3	Carb 330Ω ±5% ¼W	24332-603
R4	Carb 20kΩ ±5% 1/10W	24331-317
R5	Carb 10Ω ±5% 1/10W	24331-220
R6	Carb 330Ω ±5% ¼W	24332-663
R7	Carb 10Ω ±5% 1/10W	24331-220
R10	Carb 560Ω ±5% 1/10W	24331-272

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A6.

Circuit reference	Description	M.I. code
T1		43567-005
T2		43561-007
VT1	High speed - planar	MIP 95516
VT2	High speed - planar	MIP 95516
VT3	High speed - planar	MIP 95516
VT4	Ultra high speed - planar	MIP 95513
VT5	Ultra high speed - planar	MIP 95513
VT6	High speed - planar	MIP 95516

A7—110 MHz DCU, TM 8431

When ordering, prefix circuit reference with A7.

Circuit reference	Description	M.I. code
C1	Cer 27pF ±10% 500V	26383-160
C2	Cer 27pF ±10% 500V	26383-160
C3	Cer 15pF ±5% 500V	26343-345
C4	Cer 30pF ±10% 500V	26383-162
C5	Cer 10pF ±5% 500V	26343-337
C6	Cer 75pF ±10% 500V	26383-181
C7	Cer 22pF ±10% 500V	26343-360
C8	Cer 22pF ±10% 500V	26343-360
C9	Cer 100pF ±10% 500V	26383-187
C10	Cer 75pF ±10% 500V	26383-181
C11	Cer 10pF ±5% 500V	25343-337
C12	Cer 22pF ±10% 500V	26343-360
C13	Cer 10pF ±5% 500V	26343-337
C14	Cer 0.1μF +80% -20% 12V	26382-214
C15	Cer 15pF ±5% 500V	26343-345
C16	Cer 75pF ±10% 500V	26383-181
C17	Cer 22pF ±10% 500V	26343-360
C18	Cer 22pF ±10% 500V	26343-360
C19	Cer 75pF ±10% 500V	26383-181
C20	Cer 10pF ±5% 500V	26343-337
C21	Cer 10pF ±5% 500V	26343-337

When ordering, prefix circuit reference with A7.

Circuit reference	Description	M.I. code
C22	Cer 75pF ±10% 500V	26383-181
C23	Cer 22pF ±10% 500V	26343-360
C24	Cer 22pF ±10% 500V	26343-360
C25	Cer 75pF ±10% 500V	26383-181
C26	Cer 10pF ±5% 500V	26343-337
C27	Cer 10pF ±5% 500V	26343-337
C28	Cer 75pF ±10% 500V	26383-181
C29	Cer 22pF ±10% 500V	26343-360
C30	Cer 22pF ±10% 500V	26343-360
C31	Cer 75pF ±10% 500V	26383-181
C32	Cer 10pF ±5% 500V	26343-337
C33	Cer 0.1μF +80% -20% 12V	26382-214
C34	Cer 0.1μF +80% -20% 12V	26382-214
C35	Cer 0.1μF +80% -20% 12V	26382-214
C36	Cer 0.1μF +80% -20% 12V	26382-214
C37	Cer 0.1μF +80% -20% 12V	26382-214
C38	Cer 0.1μF +80% -20% 12V	26382-214
C39	Cer 0.1μF +80% -20% 12V	26382-214
C40	Cer 0.1μF +80% -20% 12V	26382-214
C41	Cer 0.1μF +80% -20% 12V	26382-214
C42	Cer 0.1μF +80% -20% 12V	26382-214
C43	Cer 0.1μF +80% -20% 12V	26382-214
C44	Cer 0.1μF +80% -20% 12V	26382-214
C45	Cer 0.1μF +80% -20% 12V	26382-214
C46	Cer 0.1μF +80% -20% 12V	26382-214
C47	Cer 0.1μF +80% -20% 12V	26382-214
C48	Cer 0.1μF +80% -20% 12V	26382-214
C49	Cer 0.1μF +80% -20% 12V	26382-214
C50	Cer 0.1μF +80% -20% 12V	26382-214
C51	Cer 100pF ±10% 500V	26383-187
C53	Cer 0.1μF +80% -20% 12V	26382-214
C54	Cer 0.1μF +80% -20% 12V	26382-214
C55	Cer 100pF ±10% 500V	26383-187
C56	Cer 0.1μF +80% -20% 12V	26382-214
C57	Cer 0.1μF +80% -20% 12V	26382-214
C58	Cer 0.1μF +80% -20% 12V	26382-214
C59	Cer 0.1μF +80% -20% 12V	26382-214

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A7.

Circuit reference	Description	M.I. code
C60	Cer 0.1μF +80% -20% 12V	26382-214
C61	Cer 0.1μF +80% -20% 25V	26382-627
C62	Cer 0.1μF +80% -20% 12V	26382-214
C63	Cer 0.1μF +80% -20% 12V	26382-214
C64	Cer 0.1μF +80% -20% 12V	26382-214
L4	0.15μH ±10%	23010-036
L5	0.33μH ±10%	23010-041
L6	0.39μH ±10%	23010-041
L7	0.47μH ±10%	23010-042
L8	0.18μH ±10%	23010-037
L9	0.27μH ±10%	23010-039
L10	0.39μH ±10%	23010-041
L12	0.82μH ±10%	23010-042
L13	0.39μH ±10%	23010-041
L14	0.47μH ±10%	23010-042
L15	0.47μH ±10%	23010-042
L16	0.39μH ±10%	23010-041
L17	0.39μH ±10%	23010-041
L18	0.47μH ±10%	23010-042
L19	0.47μH ±10%	23010-042
L20	0.39μH ±10%	23010-042
L21	0.39μH ±10%	23010-042
L22	0.47μH ±10%	23010-042
L23	0.47μH ±10%	23010-042
L24	0.39μH ±10%	23010-041
MR1	High speed	MIP 91008
MR2	High speed	MIP 91008
MR3	High speed	MIP 91008
MR4	High speed	MIP 91008
MR5	High speed	MIP 91008
MR6	High speed	MIP 91008
MR7	High speed	MIP 91008
MR8	High speed	MIP 91008
MR9	High speed	MIP 91008
MR11	Silicon Planar	MIP 91006
MR12	High speed	MIP 91008
MR13	Silicon planar	MIP 91006
MR14	Silicon planar	MIP 91006
MR15	High speed	MIP 91008
MR16	Silicon planar	MIP 91006
MR17	High speed	MIP 91008
MR18	High speed	MIP 91008
MR19	High speed	MIP 91008
MR20	High speed	MIP 91008
MR21	High speed	MIP 91008
MR22	High speed	MIP 91008
MR23	High speed	MIP 91008
MR24	High speed	MIP 91008
MR25	High speed	MIP 91008
MR26	Silicon planar	MIP 91006
MR27	Silicon planar	MIP 91006
MR28	Silicon planar	MIP 91006
MR29	High speed	MIP 91008
MR31	High speed	MIP 91008
MR32	Silicon planar	MIP 91006
MR33	High speed	MIP 91008
MR34	High speed	MIP 91008
MR35	High speed	MIP 91008
MR36	High speed	MIP 91008
MR37	High speed	MIP 91008
MR38	High speed	MIP 91008
MR39	High speed	MIP 91008
MR41	Silicon planar	MIP 91006
MR42	Silicon planar	MIP 91006
MR43	Silicon planar	MIP 91006
MR44	High speed	MIP 91008
MR45	High speed	MIP 91008
MR46	Silicon planar	MIP 91006
MR47	High speed	MIP 91008

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A7.

Circuit reference	Description	M.I. code
MR48	High speed	MIP 91008
MR49	High speed	MIP 91008
MR51	High speed	MIP 91008
MR52	High speed	MIP 91008
MR53	High speed	MIP 91008
MR54	High speed	MIP 91008
MR55	High speed	MIP 91008
MR56	Silicon Planar	MIP 91006
MR57	Silicon planar	MIP 91006
MR58	Silicon planar	MIP 91006
MR59	High speed	MIP 91008
MR61	High speed	MIP 91008
MR62	Silicon planar	MIP 91006
MR63	High speed	MIP 91008
MR64	High speed	MIP 91008
MR65	High speed	MIP 91008
MR66	High speed	MIP 91008
MR67	High speed	MIP 91008
R1	Carb 300Ω ±5% ¼W	24332-662
R2	Carb 3.3kΩ ±5% 0.1W	24331-294
R3	Carb 680Ω ±5% 1W°	24010-006
R4	Carb 9.1kΩ ±5% 0.1W	24331-309
R5	Carb 470Ω ±5% 0.1W	24331-269
R6	Carb 10kΩ ±5% 0.1W	24331-310
R7	Carb 100Ω ±5% ¼W	24332-650
R8	Carb 4.7kΩ ±5% 0.1W	24331-300
R9	Carb 51Ω ±5% ¼W	24332-638
R10	Carb 270Ω ±5% ¼W	24332-661
R11	Carb 10kΩ ±5% 0.1W	24331-310
R12	Carb 24kΩ ±5% 0.1W	24331-319
R13	Carb 5.1kΩ ±5% 0.1W	24331-301
R14	Carb 270Ω ±5% ¼W	24332-661
R15	Carb 100Ω ±5% ¼W	24332-650
R16	Carb 8.2kΩ ±5% 0.1W	24331-308
R17	Carb 6.2kΩ ±5% 0.1W	24331-304
R18	Carb 750Ω ±5% 0.1W	24331-277
R19	Carb 750Ω ±5% 0.1W	24331-277
R20	Carb 8.2kΩ ±5% 0.1W	24331-308
R21	Carb 100Ω ±5% ¼W	24332-650
R22	Carb 270Ω ±5% ¼W	24332-661
R23	Carb 24kΩ ±5% 0.1W	24331-319
R24	Carb 10kΩ ±5% o.1W	24331-310
R25	Carb 680Ω ±5% 0.1W	24331-276
R26	Carb 330Ω ±5% ¼W	24332-663
R27	Carb 4.3kΩ ±5% 0.1W/70°C	24331-298
R28	Carb 330Ω ±5% ¼W	24332-663
R29	Carb 5.6kΩ ±5% 0.1W/70°C	24331-303
R30	Carb 390Ω ±5% ¼W	24332-663
R31	Carb 330Ω ±5% ¼W	24332-663
R32	Carb 330Ω ±5% ¼W	24332-663
R33	Carb 330Ω ±5% ¼W	24332-663
R34	Carb 82Ω ±5% ¼W	24332-646
R35	Carb 270Ω ±5% ¼W	24332-661
R36	Carb 10kΩ ±5% 0.1W/70°C	24331-310
R37	Carb 24kΩ ±5% 0.1W/70°C	24331-319
R38	Carb 100Ω ±5% ¼W	24332-650
R39	Carb 180Ω ±5% ¼W	24332-656
R41	Carb 8.2kΩ ±5% 0.1W/70°C	24331-308
R42	Carb 750Ω ±5% 0.1W/70°C	24331-277
R43	Carb 750Ω ±5% 0.1W/70°C	24331-277
R44	Carb 6.2kΩ ±5% 0.1W/70°C	24331-304
R45	Carb 8.2kΩ ±5% 0.1W/70°C	24331-308
R46	Carb 180Ω ±5% ¼W	24332-656
R47	Carb 5.1kΩ ±5% 0.1W/70°C	24331-301
R48	Carb 100Ω ±5% ¼W	24332-650
R49	Carb 24kΩ ±5% 0.1W/70°C	24331-319
R50	Carb 620Ω ±5% 0.1W/70°C	24331-273
R51	Carb 10kΩ ±5% 0.1W/70°C	24331-310
R52	Carb 270Ω ±5% ¼W	24332-661
R53	Carb 10kΩ ±5% 0.1W/70°C	24331-310
R54	Carb 24kΩ ±5% 0.1W/70°C	24331-319
R55	Carb 100Ω ±5% ¼W	24332-650
R56	Carb 180Ω ±5% ¼W	24332-656
R57	Carb 8.2kΩ ±5% 0.1W/70°C	24331-308
R58	Carb 750Ω ±5% 0.1W/70°C	24331-277

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A7.

Circuit reference		Description	M.I. code
R59	Carb	750Ω ±5% 0.1W/70°C	24331-277
R61	Carb	8.2kΩ ±5% 0.1W/70°C	24331-308
R62	Carb	6.2kΩ ±5% 0.1W/70°C	24331-304
R63	Carb	180Ω ±5% ¼W	24332-656
R64	Carb	5.1kΩ ±5% 0.1W/70°C	24331-301
R65	Carb	100Ω ±5% ¼W	24332-650
R66	Carb	24kΩ ±5% 0.1W/70°C	24331-319
R67	Carb	10kΩ ±5% 0.1W/70°C	24331-310
R68	Carb	270Ω ±5% ¼W	24332-661
R69	Carb	10kΩ ±5% 0.1W/70°C	24331-310
R70	Carb	24kΩ ±5% 0.1W/70°C	24331-319
R71	Carb	100Ω ±5% ¼W	24331-319
R72	Carb	180Ω ±5% ¼W	24332-650
R73	Carb	8.2kΩ ±5% 0.1W/70°C	24332-656
R74	Carb	750Ω ±5% 0.1W/70°C	24331-308
R76	Carb	750Ω ±5% 0.1W/70°C	24331-277
R77	Carb	8.2kΩ ±5% 0.1W/70°C	24331-308
R78	Carb	6.2kΩ ±5% 0.1W/70°C	24331-308
R79	Carb	180Ω ±5% ¼W	24332-656
R81	Carb	5.1kΩ ±5% 0.1W/70°C	24331-301
R82	Carb	100Ω ±5% ¼W	24332-650
R83	Carb	24kΩ ±5% 0.1W/70°C	24331-319
R84	Carb	10kΩ ±5% 0.1W/70°C	24331-310
R85	Carb	220Ω ±5% ¼W	24332-658
R86	Carb	62Ω ±5% ¼W	24331-641

Circuit reference	Description	M.I. code
VT1	High speed - planar	MIP 95516
VT2	Ultra high speed - planar	MIP 95513
VT3	Ultra high speed - planar	MIP 95513
VT4	Ultra high speed - planar	MIP 95513
VT5	Epitaxial - planar	MIP 94005
VT6	Ultra high speed - planar	MIP 95513
VT7	Ultra high speed - planar	MIP 95513
VT8	Ultra high speed - planar	MIP 95513
VT9	Ultra high speed - planar	MIP 95513
VT10	High speed - planar	MIP 95516
VT11	High speed - planar	MIP 95516
VT12	High speed - epitaxial	MIP 95010
VT13	High speed - planar	MIP 95516
VT14	High speed - planar	MIP 95516
VT15	High speed - planar	MIP 95516
VT16	High speed - planar	MIP 95516
VT17	High speed - planar	MIP 95516
VT18	High speed - planar	MIP 95516
VT19	High speed - planar	MIP 95516
VT20	High speed - planar	MIP 95516
VT21	High speed - planar	MIP 95516
VT22	High speed - planar	MIP 95516
VT23	High speed - planar	MIP 95516
VT24	High speed - planar	MIP 95516
VT25	High speed - planar	MIP 95516
VT26	High speed - planar	MIP 95516

A8— Carry, Reset and Readout Buffers, TM 8433

When ordering, prefix circuit reference with A8.

C1	Cer	390pF ±10% 500V	26383-217
C2	Cer	0.1μF +80% -20% 12V	26382-214
C3	Cer	0.1μF +80% -20% 12V	26382-214
C4	Cer	50pF ±10% 500V	26383-172

MR1	General purpose	MIP 91003
MR2	Silicon planar	MIP 91006
MR3	General purpose	MIP 91003
MR4	Fast switching, high conductance	MIP 91007

R1	Carb	75kΩ ±5% 1/10W	24331-332
R2	Carb	6.2kΩ ±5% 1/10W	24331-304
R3	Carb	330Ω ±5% ¼W	24332-063
R4	Carb	5.6kΩ ±5% 1/10W	24331-303
R5	Carb	4.7kΩ ±5% 1/10W	24331-300

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A8.

Circuit reference	Description	M.I. code
R6	Carb 30kΩ ±5% 1/10W	24331-321
R7	Carb 4.7kΩ ±5% 1/10W	24331-300
R8	Carb 30kΩ ±5% 1/10W	24331-321
R9	Carb 4.7kΩ ±5% 1/10W	24331-300
R10	Carb 30kΩ ±5% 1/10W	24331-321
R11	Carb 4.7kΩ ±5% 1/10W	24331-300
R12	Carb 30kΩ ±5% 1/10W	24331-321
R13	Carb 5.6kΩ ±5% 1/10W	24331-303
R14	Carb 18kΩ ±5% 1/10W	24331-316
R15	Carb 3kΩ ±5% 1/10W	24331-293
R16	Carb 5.6kΩ ±5% 1/10W	24331-303
R17	Carb 18kΩ ±5% 1/10W	24331-316
R18	Carb 3kΩ ±5% 1/10W	24331-293
R19	Carb 820Ω ±5% 1/10W	24331-278
R20	Carb 3kΩ ±5% 1/10W	24331-293
R21	Carb 820Ω ±5% 1/10W	24331-278
R22	Carb 3kΩ ±5% 1/10W	24331-293
R23	Carb 3kΩ ±5% 1/10W	24331-293
R24	Carb 820Ω ±5% 1/10W	24331-278
R25	Carb 3kΩ ±5% 1/10W	24331-293
R26	Carb 820Ω ±5% 1/10W	24331-278
R27	Carb 3kΩ ±5% 1/10W	24331-293
R28	Carb 18kΩ ±5% 1/10W	24331-316
R29	Carb 5.6kΩ ±5% 1/10W	24331-303
R30	Carb 3kΩ ±5% 1/10W	24331-293
R31	Carb 18kΩ ±5% 1/10W	24331-316
R32	Carb 5.6kΩ ±5% 1/10W	24331-303

Circuit reference	Description	M.I. code
VT1	General purpose	MIP 95008
VT2	High speed - epitaxial	MIP 95016
VT3	General purpose	MIP 95008
VT4	General purpose	MIP 95008
VT5	General purpose	MIP 95008
VT6	General purpose	MIP 95008
VT7	General purpose	MIP 95511
VT8	General purpose	MIP 95511
VT9	General purpose	MIP 95511
VT10	General purpose	MIP 95511

A9— Count Select Gates, TM 8436

When ordering, prefix circuit reference with A9.

C1	Cer 100pF ±10% 500V	26383-187
C2	Cer 0.1μF +80% -20% 12V	26382-214
C3	Cer 0.02μF +50% -25% 12V	26383-007
C5	Cer 15pF ±5% 500V	26343-345
C6	Cer 0.1μF +80% -20% 12V	26382-214
C8	Cer 22pF ±10% 500V	26343-360
C9	Cer 12pF ±5% 500V	26343-341
C10	Cer 0.05μF 20V	26010-029
C11	Cer 0.05μF 20V	26010-029
C12	Cer 0.1μF +80% -20% 12V	26382-214
C13	Cer 0.1μF +80% -20% 12V	26382-214

L1	0.22μH ±10%	23010-038
L2	0.24mH ±10%	23010-033
L3	0.24mH ±10%	23010-033
L4	0.24mH ±10%	23010-033
L5	0.24mH ±10%	23010-033

MR1	Silicon planar	MIP 91006
MR2	Fast switching, high conductance	MIP 91007
MR3	High speed	MIP 91008
MR4	Silicon planar	MIP 91006
MR5	High speed	MIP 91008
MR6	Silicon planar	MIP 91006
MR7	High speed	MIP 91008
MR8	High speed	MIP 91008

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A9.

Circuit reference	Description	M.I. code
R1	Carb 30kΩ ±5% 1/10W	24331-321
R2	Carb 2kΩ ±5% 1/10W	24332-287
R3	Carb 100Ω ±5% 1/10W	24331-250
R4	Carb 68Ω ±5% 1/10W	24331-243
R5	Carb 270Ω ±5% 1/4W	24332-661
R7	Carb 36kΩ ±5% 1/10W	24331-323
R9	Carb 30kΩ ±5% 1/10W	24331-321
R10	Carb 30kΩ ±5% 1/10W	24331-321
R11	Carb 220Ω ±5% ¼W	24332-658
R12	Carb 68Ω ±5% 1/10W	24331-243
R13	Carb 680Ω ±5% 1/10W	24331-276
VT1	High speed - planar	MIP 95511
VT2	Epitaxial - planar	MIP 94005
VT3	Ultra high speed - planar	MIP 95513
VT4	High speed - planar	MIP 95511
VT5	Ultra high speed - planar	MIP 95513
VT6	High speed - planar	MIP 95516

A10— Gate Control, TM 8432

When ordering, prefix circuit reference with A10.

C1	Cer 15pF ±5%	26340-345
C2	Cer 15pF ±5%	26343-345
C3	Cer 27pF ±10%	26383-160
C4	Cer 0.1μF +80% -20% 12V	26382-214
C5	Cer 15pF ±5%	26343-345
C6	Cer 27pF ±10%	26383-160
C7	Cer 15pF ±5%	26343-345
C8	Cer 39pF ±10%	26383-168
C9	Cer 62pF ±10%	26383-177
C10	Cer 15pF ±5%	26343-345
C11	Cer 0.1μF +80% -20% 12V	26382-214
C12	Cer 0.1μF +80% -20% 12V	26382-214
C13	Cer 39pF ±10%	26383-168

When ordering, prefix circuit reference with A10.

C14	Cer 0.1μF +80% -20% 12V	26382-214
C15	Cer 15pF ±5%	26343-345
C16	Cer 100pF ±10%	26383-187
C17	Cer 100pF ±10%	26383-187
C18	Cer -.1μF +80% -20% 12V	26382-214
C19	Cer 100pF ±10%	26383-187
C20	Cer 100pF ±10%	26383-187
C21	Cer 0.01μF ±10% 200V	26386-183
C22	Cer 0.1μF +80% -20% 12V	26382-214
C23	Cer 0.1μF +80% -20% 12V	26382-214
C24	Cer 0.1μF +80% -20% 12V	26382-214
C25	Cer 0.1μF +80% -20% 12V	26382-214
C26	Cer 0.02μF +80% -20% 25V	26010-028
C27	Cer 0.02μF +80% -20% 25V	26010-028
C28	Cer 0.01μF +80% -20% 12V	26382-214
C36	Cer 0.1μF +80% -20% 12V	26382-214
C37	Cer 0.1μF +80% -20% 12V	26382-214
C38	Cer 0.02μF +80% -20% 25V	26010-028
C39	Cer 0.1μF +80% -20% 12V	26382-214
C40	Cer 0.02μF +80% -20% 25V	26010-028
C41	Cer 0.1μF +80% -20% 12V	26382-214
L1	0.24mH ±10%	23010-033
L2	0.24mH ±10%	23010-033
L3	0.24mH ±10%	23010-033
L4	0.24mH ±10%	23010-033
MR1	Silicon planar	MIP 91006
MR2	High speed	MIP 91008
MR3	High speed	MIP 91008
MR4	High speed	MIP 91008
MR5	High speed	MIP 91008
MR6	High speed	MIP 91008
MR7	Silicon planar	MIP 91006
MR9	High speed	MIP 91008

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A10.

Circuit reference	Description	M.I. code
MR11	Silicon planar	MIP 91006
MR12	Silicon planar	MIP 91006
MR13	Silicon planar	MIP 91006
MR14	Silicon planar	MIP 91006
MR15	Silicon planar	MIP 91006
MR16	High conductance	MIP 91004
MR17	High conductance	MIP 91004
MR18	Silicon planar	MIP 91006
MR19	Silicon planar	MIP 91006
MR20	General purpose	MIP 91003
MR21	Tunnel	MIP 93007
MR22	Medium voltage rectifier	MIP 92006
MR23	General purpose	MIP 91003
MR24	General purpose	MIP 91003
MR25	General purpose	MIP 91003
MR26	Tunnel	MIP 93007
MR27	Medium voltage rectifier	MIP 92006
MR28	Fast switching, high conductance	MIP 91007
MR29	Fast switching, high conductance	MIP 91007
MR30	Silicon planar	MIP 91006
MR31	Silicon planar	MIP 91006
MR32	Fast switching, high conductance	MIP 91007
MR33	Silicon planar	MIP 91006
MR34	Silicon planar	MIP 91006
MR35	General purpose	MIP 91003
MR36	General purpose	MIP 91003
R1	Carb 120Ω ±10% $\frac{1}{2}$W	24010-021
R2	Carb 680Ω ±5% 1W°	24010-006
R3	Carb 2.4kΩ ±5% 0.1W	24331-289
R4	Carb 4.7kΩ ±5% 0.1W	24331-300
R5	Carb 1.2kΩ ±5% 0.1W	24331-282
R6	Carb 1.2kΩ ±5% 0.1W	24331-282
R7	Carb 4.7kΩ ±5% 0.1W	24331-300
R8	Carb 2.4kΩ ±5% 0.1W	24331-289
R9	Carb 680Ω ±5% 1W°	24010-006
R10	Carb 15kΩ ±5% 1/10W	24331-314
R11	Carb 1.5kΩ ±5% 0.1W	24331-284
R12	Carb 390Ω ±5% $\frac{1}{4}$W	24332-065
R13	Carb 680Ω ±5% $\frac{1}{4}$W*	24332-076
R14	Carb 30kΩ ±5% 0.1W	24331-321
R15	Carb 330Ω ±5% $\frac{1}{4}$W*	24332-063
R16	Carb 2kΩ ±5% 0.1W	24331-287
R17	Carb 2.4kΩ ±5% 0.1W	24331-289
R18	Carb 1.8kΩ ±5% 0.1W	24331-286
R19	Carb 4.7kΩ ±5% 0.1W	24331-300
R20	Carb 30kΩ ±5% 0.1W	24331-321
R21	Carb 2.4kΩ ±5% 0.1W	24331-289
R22	Carb 5.6kΩ ±5% 0.1W	24331-303
R23	Carb 220Ω ±5% 0.1W	24331-258
R24	Carb 15kΩ ±5% 0.1W	24331-314
R25	Carb 4.3kΩ ±5% 0.1W	24331-298
R26	Carb 1kΩ ±5% 0.1W	24331-280
R27	Carb 220Ω ±5% $\frac{1}{4}$W*	24010-026
R28	Carb 180Ω ±5% $\frac{1}{2}$W°	24010-026
R29	Carb 220Ω ±5% $\frac{1}{4}$W	24332-058
R30	Carb 7.5Ω ±10% 0.1W	24321-617
R31	Carb 270Ω ±5% $\frac{1}{4}$W*	24332-061
R33	Carb 75Ω ±5% $\frac{1}{2}$W°	24010-024
R34	Carb 2kΩ ±5% 0.1W	24331-287
R35	Carb 3.9kΩ ±5% 0.1W	24331-296
R36	Carb 510Ω ±5% $\frac{1}{4}$W	24332-071
R38	Carb 470Ω ±5% 0.1W	24331-269
R39	Carb 15kΩ ±5% 0.1W	24331-310
R40	Carb 4.3kΩ ±5% 0.1W	24331-298
R41	Carb 1kΩ ±5% 0.1W	24331-280
R42	Carb 180Ω ±5% $\frac{1}{2}$W°	24010-026
R43	Carb 220Ω ±5% $\frac{1}{4}$W*	24332-058
R44	Carb 270Ω ±5% $\frac{1}{4}$W*	24332-061
R45	Carb 7.5Ω ±10% 0.1W	24321-617
R47	Carb 75Ω ±5% $\frac{1}{2}$W°	24010-021

For symbols and abbreviations see introduction to this chapter

When ordering, prefix circuit reference with A10.

Circuit reference		Description	M.I. code
R48	Carb	220Ω ±5% ¼W	24332-058
R49	Carb	510Ω ±5% ¼W	24332-071
R50	Carb	2kΩ ±5% 0.1W	24331-287
R51	Carb	3.9kΩ ±5% 0.1W	24331-296
R52	Carb	680Ω ±5% ¼W*	24332-076
R53	Carb	20kΩ ±5% 0.1W	24331-317
R54	Carb	3.9kΩ ±5% 0.1W	24331-296
R55	Carb	18kΩ ±5% 0.1W	24331-316
R56	Carb	3kΩ ±5% 0.1W	24331-293
R57	Carb	3kΩ ±5% 0.1W	24331-293
R58	Carb	20kΩ ±5% 0.1W	24331-317
R59	Carb	3.9kΩ ±5% 0.1W	24331-298
R61	Carb	18kΩ ±5% 0.1W	24331-316
R62	Carb	3kΩ ±5% 0.1W	24331-293
R63	Carb	3kΩ ±5% 0.1W	24331-293
R64	Carb	470Ω ±5% 0.1W	24331-269
R65	Carb	10kΩ ±5% 0.1W	24331-310
R66	Carb	1kΩ ±5% 0.1W	24331-280
R67	Carb	5.6kΩ ±5% 0.1W	24331-303
R68	Carb	220Ω ±5% ¼W*	24332-058
R69	Carb	75Ω ±5% ½W°	24010-024
R71	Carb	3kΩ ±5% 0.1W	24331-293
R72	Carb	3kΩ ±5% 0.1W	24331-293
R73	Carb	18kΩ ±5% 0.1W	24331-316
R74	Carb	12kΩ ±5% 0.1W	24331-312
R75	Carb	36Ω ±5% 1W°	24010-004
R76	Carb	1kΩ ±5% ½W°	24010-028
R77	Carb	1.8kΩ ±5% 0.1W	24331-286
R79	Carb	3.9kΩ ±5% 0.1W	24331-296
R80	Carb	2kΩ ±5% 0.1W	24331-287
R81	Carb	6.2kΩ ±5% 0.1W	24331-304
RV1		200Ω ±10% ¼W	25886-192
RV2		200Ω ±10% ¼W	25886-192
RV3		200Ω ±10% ¼W	25886-192
RV4		1kΩ ±10% ¼W	25886-195
VT1		High speed - planar	MIP 95516
VT2		High speed - planar	MIP 95513
VT3		High speed - planar	MIP 95513
VT4		High speed - planar	MIP 95516
VT5		High speed - planar	MIP 95516
VT6		High speed - planar	MIP 95516
VT7		High speed - planar	MIP 95516
VT8		High speed - planar	MIP 95511
VT9		High speed - planar	MIP 95511
VT10		High speed - planar	MIP 95511
VT11		High speed - planar	MIP 95513
VT12		High speed - planar	MIP 95516
VT13		High speed - planar	MIP 95511
VT14		High speed - planar	MIP 95511
VT15		High speed - planar	MIP 95513
VT16		High speed - planar	MIP 95516
VT17		High speed - planar	MIP 95511
VT18		High speed - planar	MIP 95511
VT19		High speed - planar	MIP 95511
VT20		High speed - planar	MIP 95511
VT21		High speed - planar	MIP 95516
VT22		High speed - planar	MIP 95511
VT23		High speed - planar	MIP 95511
VT24		High speed - planar	MIP 95511
VT25		High frequency - planar	MIP 95515
VT26		Intermediate power	MIP 95512

For symbols and abbreviations see introduction to this chapter

A11 — Input Amplifier, TM 8342

When ordering, prefix circuit reference with A11.

Comprising units A1, A2, A3 and A4 plus the following components:

Circuit reference	Description	M.I. code
C1	Cer Ø 0.001μF +80% -20% 300V	26373-733
C2	Cer Ø 0.001μF +80% -20% 300V	26373-733
C3	Cer Ø 0.001μF +80% -20% 300V	26373-733
C6	Cer Ø 0.001μF +80% -20% 300V	26373-733
C9	Cer Ø 0.001μF +80% -20% 300V	26373-733
C10	Cer Ø 0.001μF +80% -20% 300V	26373-733
C11	Cer Ø 0.001μF +80% -20% 300V	26373-733
C12	Cer Ø 0.001μF +80% -20% 300V	26373-733
C13	Cer Ø 0.001μF +80% -20% 300V	26373-733
C14	Cer Ø 0.001μF +80% -20% 300V	26373-733
C15	Cer Ø 0.001μF +80% -20% 300V	26373-733
C16	Cer 0.1 μF +80% -20% 12V	26382-214
C17	Cer 0.1 μF +80% -20% 12V	26382-214
C18	Cer 0.1 μF +80% -20% 12V	26382-214
C19	Cer 0.1 μF ±20% 25V	26382-627
C20	Cer 0.1 μF +80% -20% 12V	26382-214
C21	Elec 100μF ±20% 10V	26488-234
C22	Cer 5pF ±0.5pF 500V	26343-306
C23	Cer 1pF ±0.25pF 750V	26324-005
C24	Cer 2pF ±0.5pF 500V	26343-304
C25	Cer 30pF ±10% 500V	26383-162
C26	Cer 2pF ±0.5pF 500V	26343-304
C27	Cer 100pF ±10% 500V	26383-187
C28	Cer 0.1μF ±20% 25V	26382-627
C29	Cer 0.1μF +80% -20% 12V	26382-214
PL1	10 way	23435-230
R1	Carb 39Ω ±5% ¼W	24332-035
R2	Carb 20kΩ ±5% 1/10W	24331-317
R3	Carb 91kΩ ±5% 1/10W	24331-334
R4	Carb 300kΩ ±5% 1/10W	24331-347
R5	Carb 1MΩ ±5% ¼W	24332-766
R6	Carb 47Ω ±10% 1/10W	24341-237
R7	Carb 47Ω ±10% 1/10W	24341-237
R8	Carb 56Ω ±5% ¼W	24332-035
R9	Carb 47Ω ±10% 1/10W	24341-237
S101	5 pos	44324-217
SKT100	Coaxial 75Ω	23443-448

For symbols and abbreviations see introduction to this chapter

Chapter 6

Circuit diagrams

Circuit notes

1. ARRANGEMENT

The inter-unit wiring diagram, Fig. 6.1, shows all sub-assembly units in the equipment together with their reference designators (A1, A2 etc.) and type numbers (prefixed TM). Components that are not on a sub-assembly are part of the main chassis assembly (designated A0).

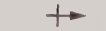
2. COMPONENT VALUES

Resistors: No suffix = ohms, k = kilohms, M = megohms.
Capacitors: No suffix = microfarads, p = picofarads.
Inductors: No suffix = henries, m = millihenries, μ = microhenries.
† : value selected during test, nominal value shown.

3. VOLTAGES

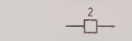
Printed in italics. Voltages are d.c. and relative to chassis unless otherwise indicated. Measured with a 20 kΩ/V meter.
→ arrow indicates voltage source point.

4. SYMBOLS

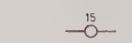

arrow indicates clockwise rotation of knob.

preset component.

panel marking.



printed board tag number.



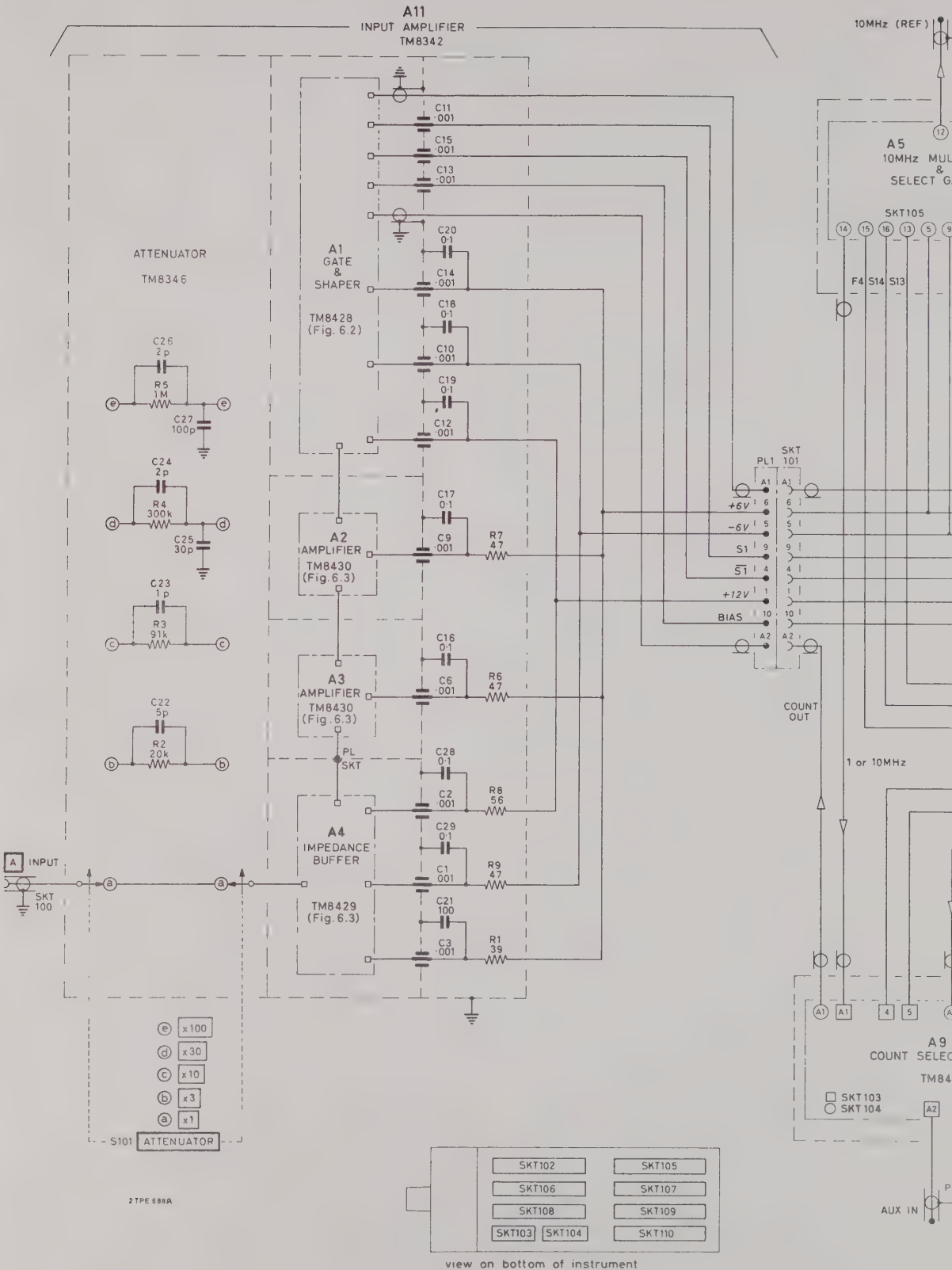
other tag.

printed board edge connector.

5. SWITCHES

Rotary switches are drawn schematically. Numbers of letters indicate control knob setting as shown in the key diagrams. Sequence of sections reading from control knob end is as follows:-

1F = 1st section, front
1B = 1st section, back
2F = 2nd section, front
etc.


A11
INPUT AMPLIFIER
TM8342
ATTENUATOR
TM8346
A1
GATE
&
SHAPER
TM8428
(Fig. 6.2)
A2
AMPLIFIER
TM8430
(Fig. 6.3)
A3
AMPLIFIER
TM8430
(Fig. 6.3)
A4
IMPEDANCE
BUFFER
TM8429
(Fig. 6.3)
PL
SKT
INPUT
SKT
100
S101
ATTENUATOR
x100
x30
x10
x3
x1
2TPE 688A
SKT102
SKT105
SKT106
SKT107
SKT108
SKT109
SKT103
SKT104
SKT110
view on bottom of instrument
10MHz (REF)
A5
10MHz MUL
&
SELECT G
SKT105
F4 S14 S13
SKT
PL1 101
+6V
-6V
S1
S1
+12V
BIAS
COUNT
OUT
1 or 10MHz
A9
COUNT SELEC
TM84
SKT103
SKT104
AUX IN

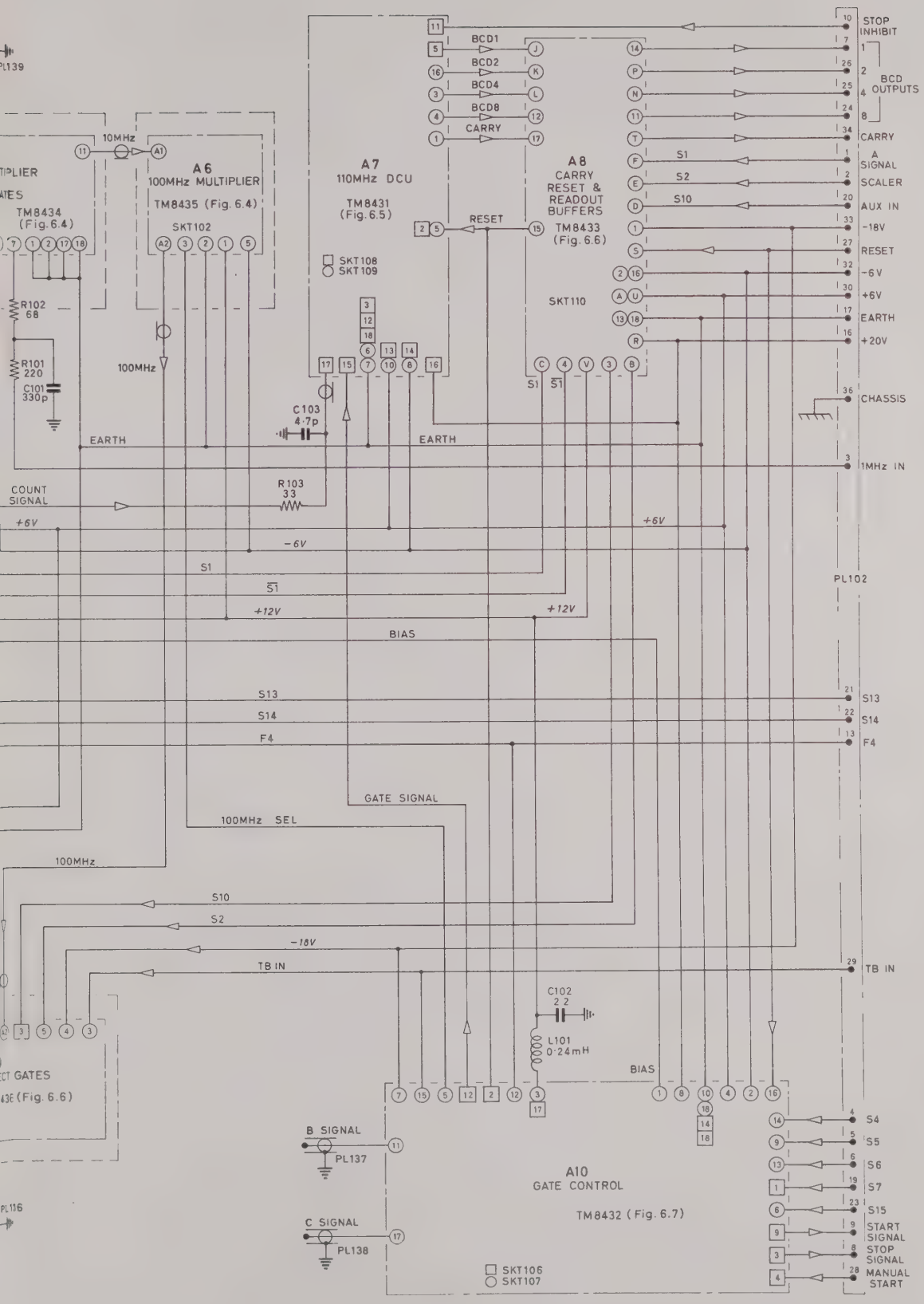
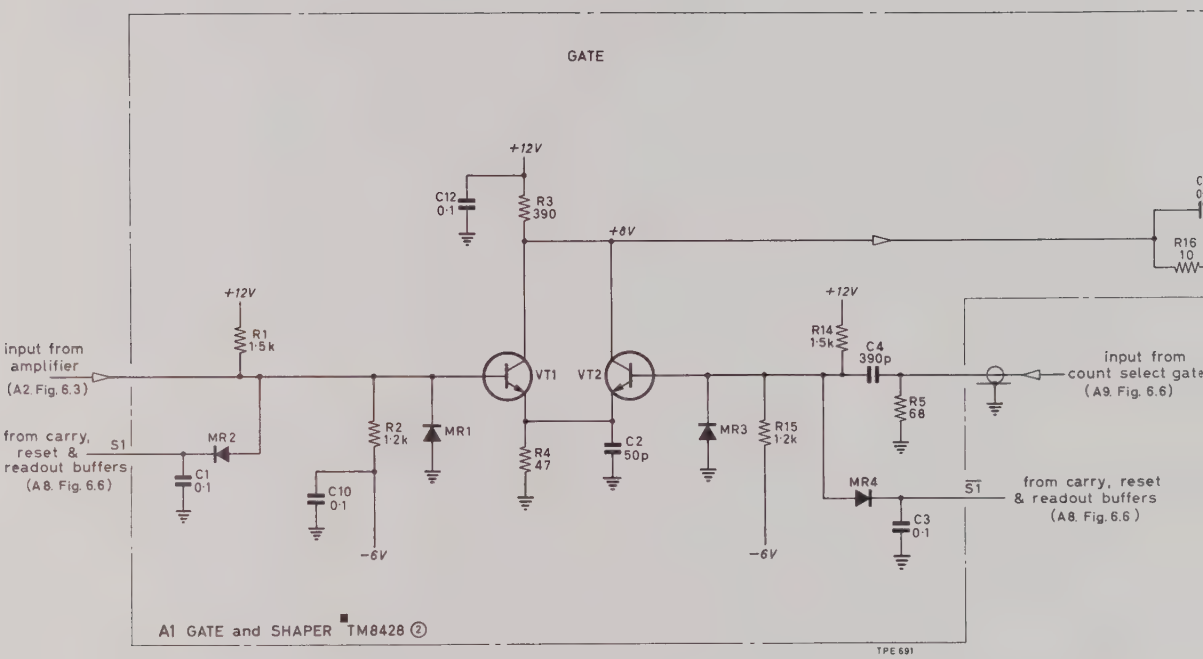


Fig. 6.1 Interconnecting diagram


GATE
+12V
C12
0·1
R3
390
+8V
R16
10
+12V
R1
1·5k
input from
amplifier
(A2. Fig. 6.3)
VT1
VT2
+12V
R14
1·5k
C4
390p
input from
count select gate
(A9. Fig. 6.6)
R5
68
from carry,
reset &
readout buffers
(A8. Fig. 6.6)
S1
MR2
C1
0·1
R2
1·2k
MR1
C10
0·1
-6V
R4
47
C2
50p
MR3
R15
1·2k
-6V
MR4
S1
from carry, reset
& readout buffers
(A8. Fig. 6.6)
C3
0·1
A1 GATE and SHAPER TM8428 ②
TPE 691

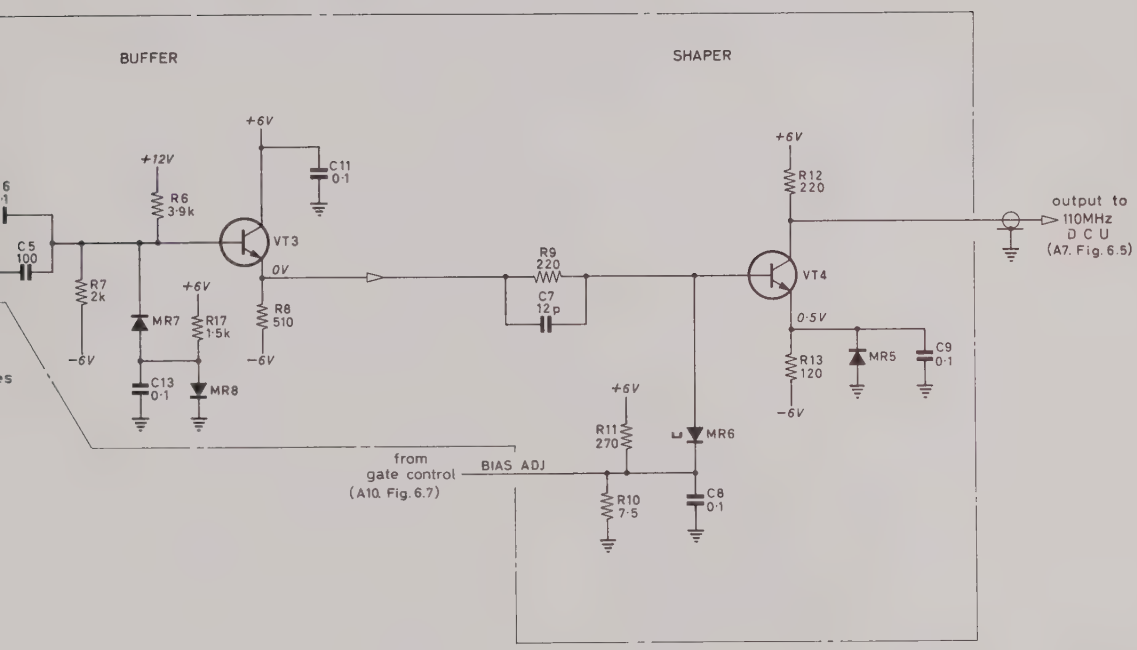
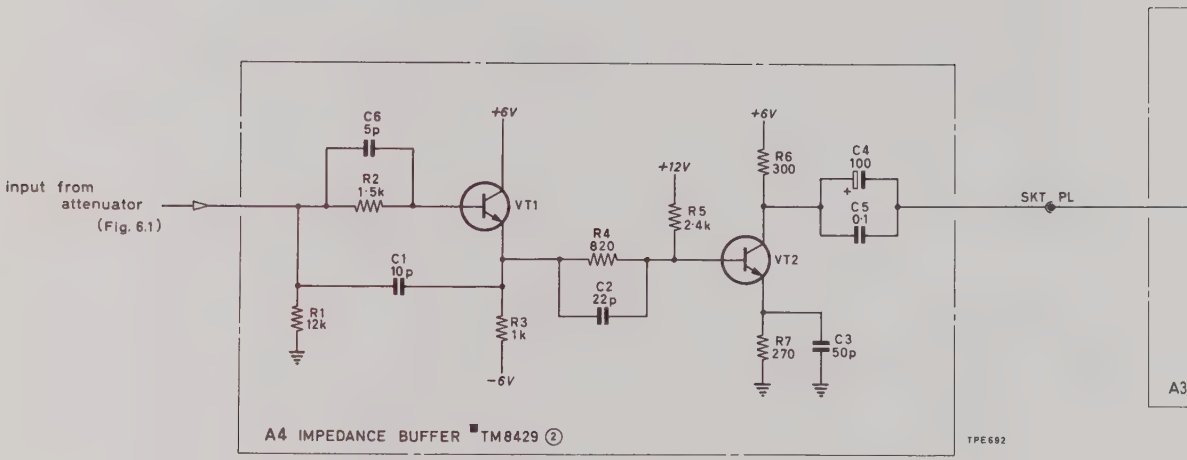


Fig. 6.2 Gate and Shaper, TM 8428


input from attenuator (Fig. 6.1)
C6 5p
R2 1·5k
+6V
VT1
C1 10p
R1 12k
R3 1k
-6V
R4 820
C2 22p
+12V
R5 2·4k
+6V
R6 300
VT2
R7 270
C3 50p
C4 100
C5 0·1
SKT PL
A4 IMPEDANCE BUFFER TM8429 (2)
TPE692
A3

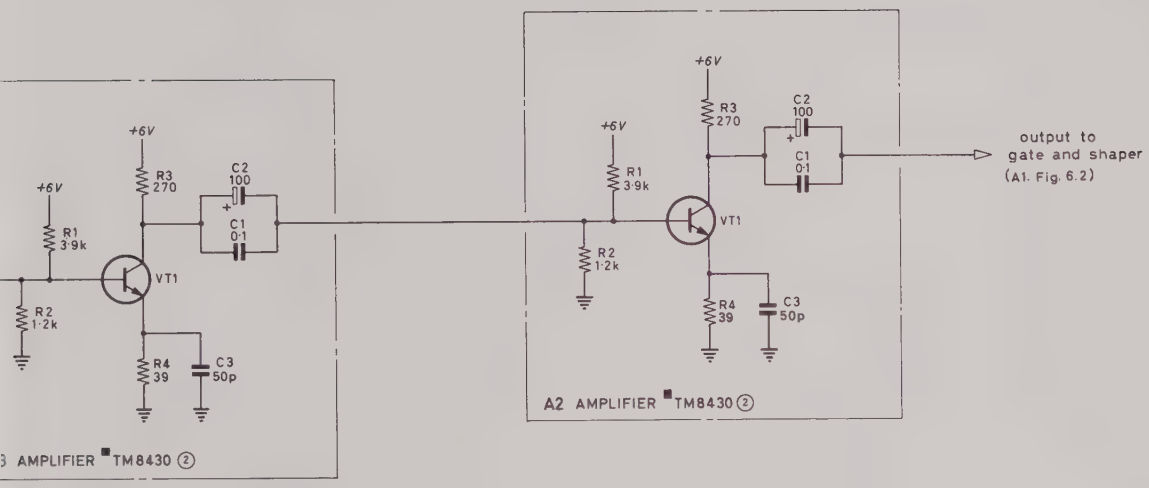
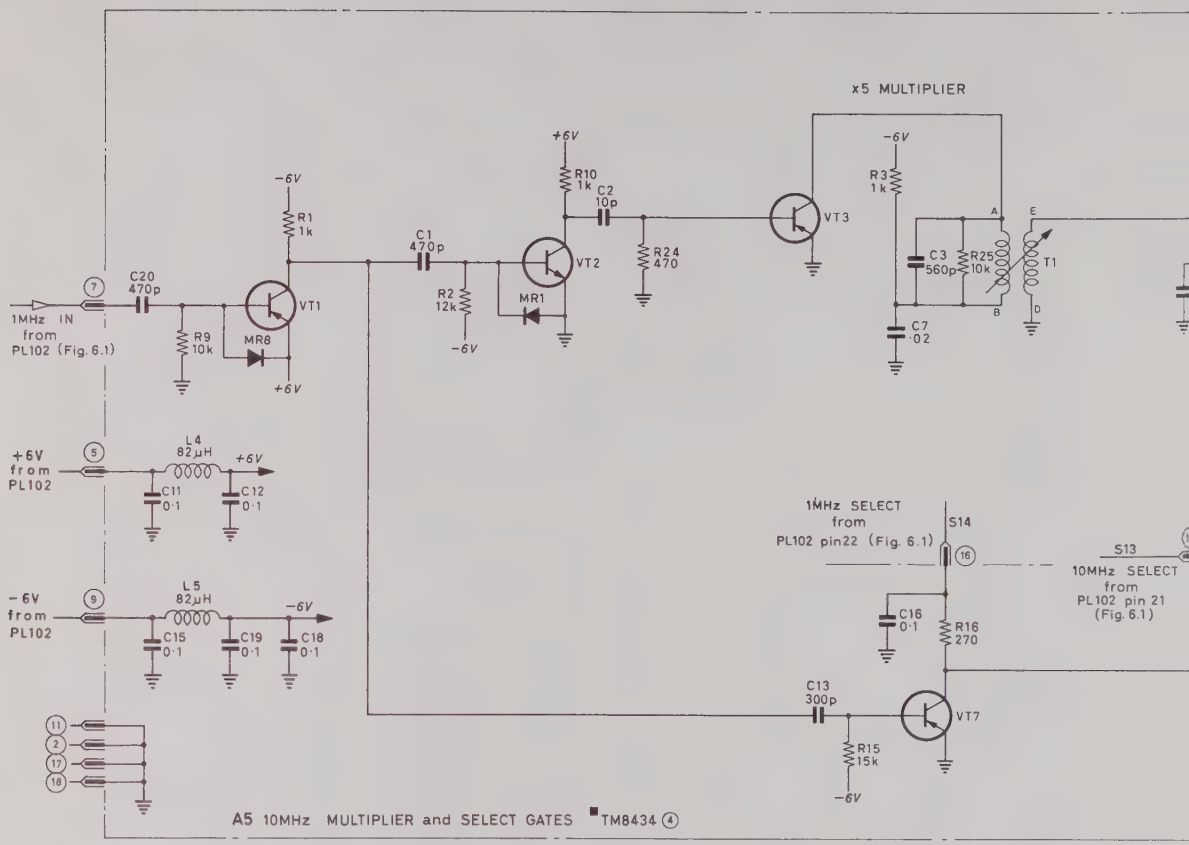
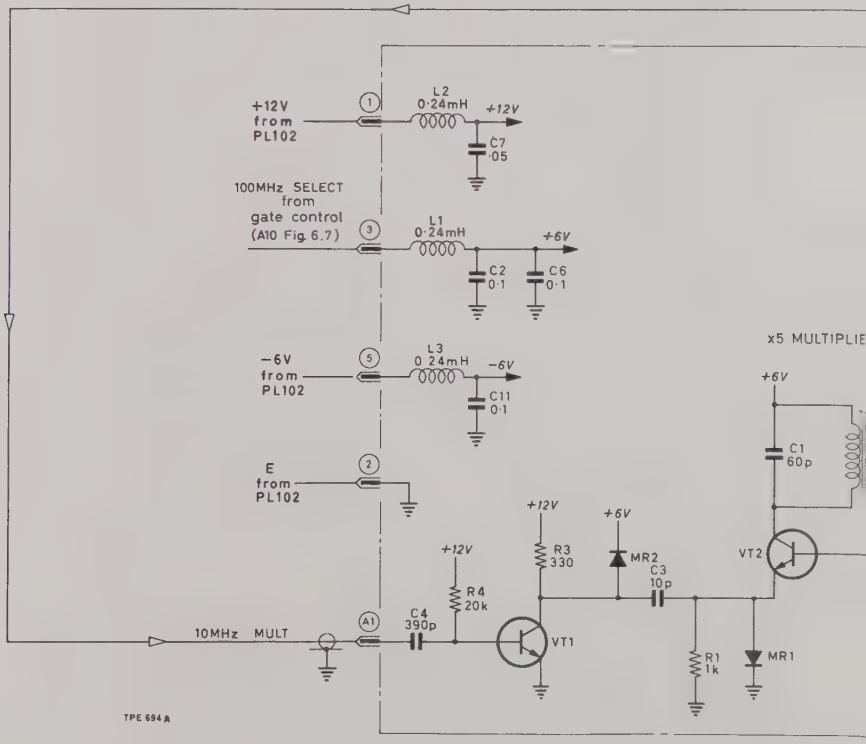


Fig. 6.3 Impedance Buffer, TM 8429, and Amplifier, TM 8430


x5 MULTIPLIER
1MHz IN from PL102 (Fig. 6.1)
+6V from PL102
-6V from PL102
1MHz SELECT from PL102 pin22 (Fig. 6.1)
10MHz SELECT from PL102 pin 21 (Fig. 6.1)
S13
S14
C20 470p
R1 1k
C1 470p
R2 12k
R10 1k
C2 10p
R24 470
R3 1k
C3 560p
R25 10k
T1
C7 ·02
R9 10k
MR8
MR1
VT1
VT2
VT3
L4 82µH
L5 82µH
C11 0·1
C12 0·1
C15 0·1
C19 0·1
C18 0·1
C16 0·1
R16 270
C13 300p
R15 15k
VT7
A5 10MHz MULTIPLIER and SELECT GATES TM8434 (4)


+12V from PL102
100MHz SELECT from gate control (A10 Fig. 6.7)
-6V from PL102
E from PL102
10MHz MULT
L2 0·24mH
L1 0·24mH
L3 0·24mH
C7 ·05
C2 0·1
C6 0·1
C11 0·1
C4 390p
R4 20k
R3 330
MR2
C3 10p
R1 1k
MR1
C1 60p
VT1
VT2
x5 MULTIPLIE
TPE 694 A

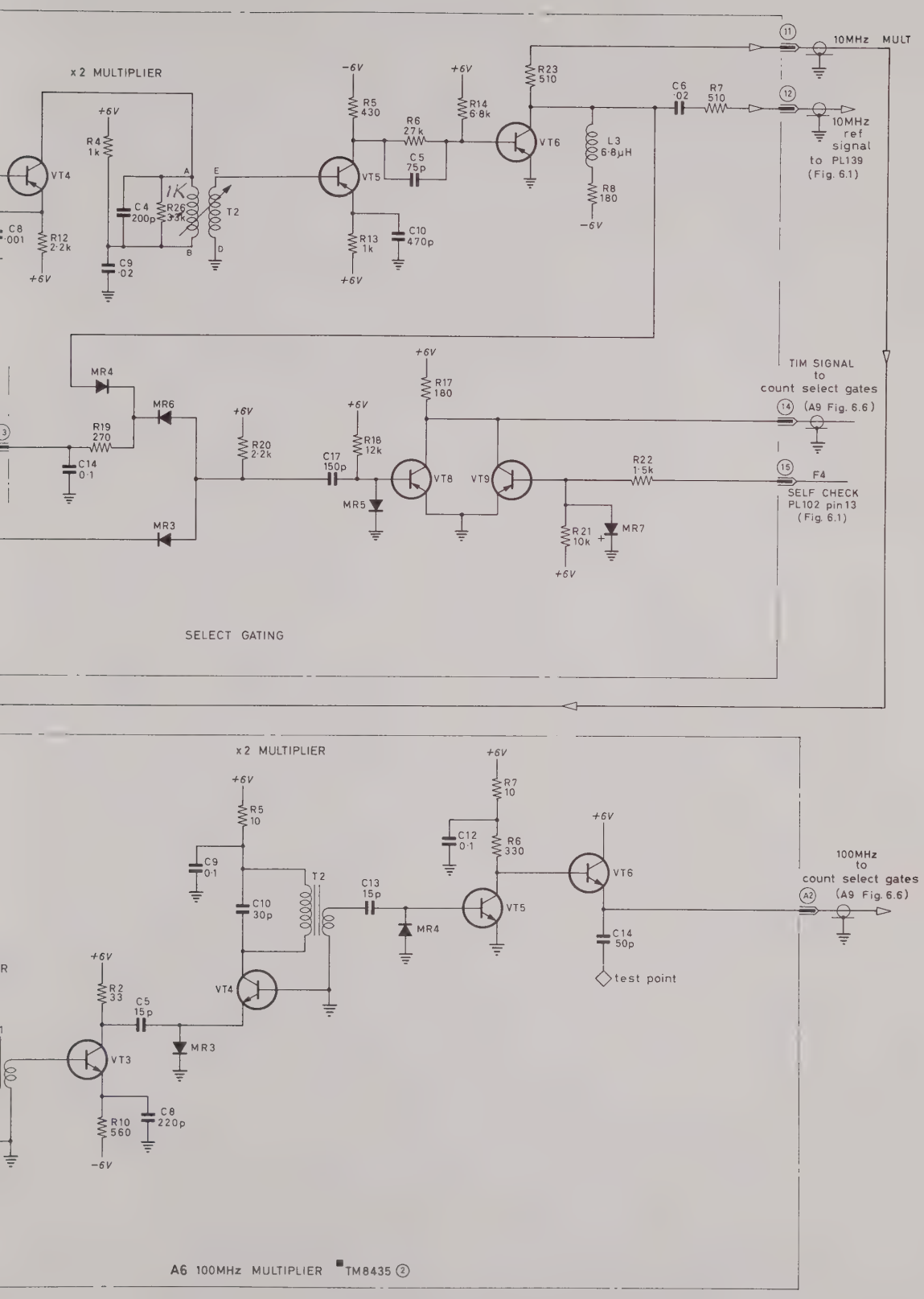


Fig. 6.4 10 MHz Multiplier and Select Gates, TM 8434, and 100 MHz Multiplier, TM 8435

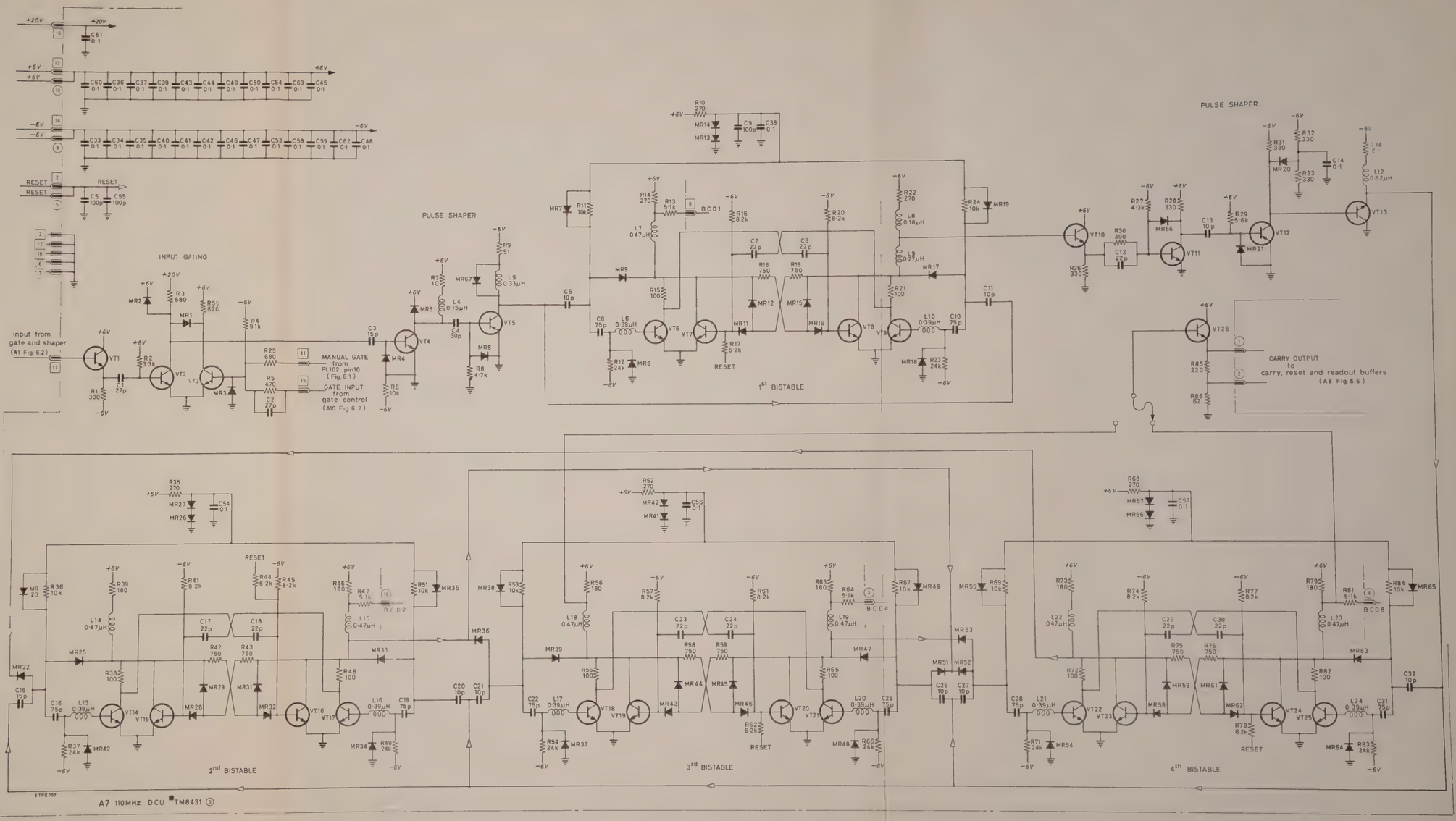


Fig. 6.5 110 MHz Decade Counting Unit, TM 8431

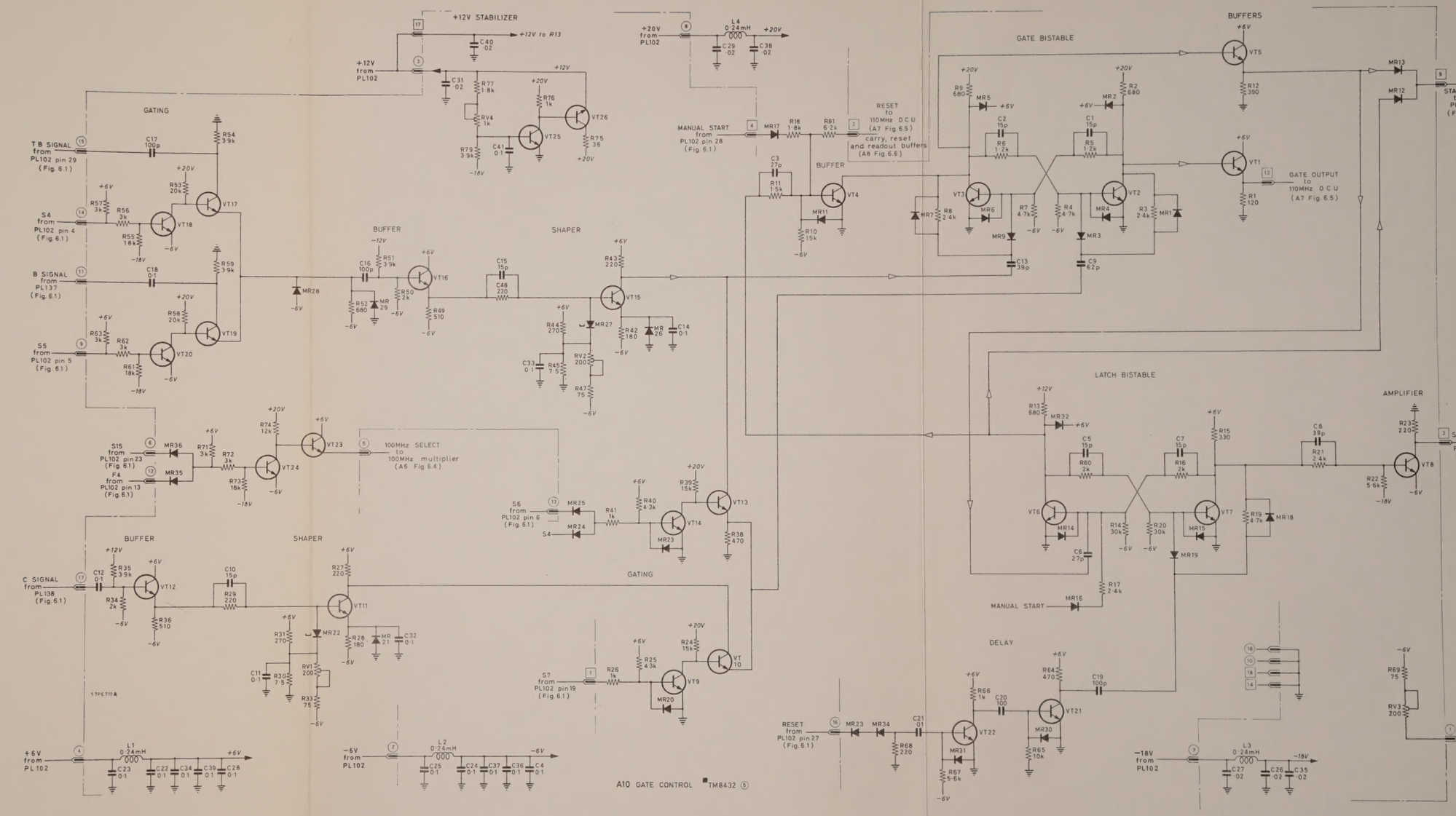

+12V STABILIZER
+12V to R13
+12V from PL102
+20V from PL102
L4 0·24mH
GATING
T B SIGNAL from PL102 pin 29 (Fig. 6.1)
S4 from PL102 pin 4 (Fig. 6.1)
B SIGNAL from PL137 (Fig. 6.1)
S5 from PL102 pin 5 (Fig. 6.1)
BUFFER
SHAPER
MANUAL START from PL102 pin 28 (Fig. 6.1)
RESET to 110MHz D C U (A7 Fig. 6.5) carry, reset and readout buffers (A8 Fig. 6.6)
GATE BISTABLE
BUFFERS
START SIGNAL to PL102 pin 9 (Fig. 6.1)
GATE OUTPUT to 110MHz D C U (A7 Fig. 6.5)
LATCH BISTABLE
AMPLIFIER
STOP SIGNAL to PL102 pin 8 (Fig. 6.1)
S15 from PL102 pin 23 (Fig. 6.1)
F4 from PL102 pin 13 (Fig. 6.1)
100MHz SELECT to 100MHz multiplier (A6 Fig. 6.4)
S6 from PL102 pin 6 (Fig. 6.1)
C SIGNAL from PL138 (Fig. 6.1)
S7 from PL102 pin 19 (Fig. 6.1)
MANUAL START
DELAY
RESET from PL102 pin 27 (Fig. 6.1)
+6V from PL102
−6V from PL102
−18V from PL102
A AMP BIAS to SKT101 pin10 (Fig. 6.1)
A10 GATE CONTROL TM8432

Fig. 6.7 Gate Control, TM 8432

TM 8267

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